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ELECTRICAL WORLD

June 30
1934

What Indiana's New Law Has Accomplished

Sponsored by Governor McNutt this year-old utility act was aimed for spectacular reforms. Here is what the test of time has shown it to be from several viewpoints.

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ELECTRICAL WORLD

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L. W. W. MORROW, *Editor*

New Trends in Engineering Education

THE meeting of 1,100 engineering educators at Cornell last week afforded evidence that education is changing to meet new conditions. The immediate practical problem is overproduction of engineers. The market at present cannot absorb the output of the engineering schools. But beyond the practical aspect there are two or three trends that are very significant and encouraging.

The first is the introduction of new technique and new ideas, through which the social and economic effects of engineering will be woven into the educational fabric. There are definite attempts to place engineering education on a broader base, whereby the engineer will contribute to the advancement of man's standard of living. The addition of another year and the use of electives in the normal four-year course are the favored methods adopted to introduce this humanitarian element into engineering education.

However, there is also a desire to be more thorough in the training of selected men for the specialized technical and professional engineering fields. Standards for this selected group are being raised. Traditional courses are being culled of obsolete or routine subject matter and new principles of science are being introduced and taught rigorously. It is admitted that this group should be relatively few in numbers and that they should be taught essential principles rather than field engineering practices.

In addition, there is a significant attempt to train a large group of men for life and not for engineering. There is a growing demand in business and in industry for men who are educated in technology, in business, in psychology and in other broad subjects, and the fact that the product of the present engineering schools most closely fits the specifications is influencing the schools to enlarge upon the idea and improve their present courses.

To these three trends must be added an improved technique in teaching, more option in selection of subject matter on the part of the student and a keener realization that a course in engineering has education as its objective. It is encouraging and stimulating to find engineering educators responding so rapidly and logically to the new environment and the new ideas. Each school must adapt itself to the new conditions as best it may and there is no general rule. It would be well, however, to carry out the principles and develop them into practices based upon four years in college. Adding a fifth year is not the general answer to either the new demands for specialization or for breadth. Flexibility in courses, a careful selection of subject matter for each course and the application of the principle that it is education that is desired will permit of meeting the changed educational specifications in four years of undergraduate work.

THUS, overproduction in engineering education is a temporary state that is forcing logical changes, even though engineers will continue to be in demand. There is only a temporary stagnation in national technological expansion. It serves, however, to force some logical modifications into engineering courses and is stimulating in its effects on educators. This record-breaking meeting of the Society for the Promotion of Engineering Education gave full assurance that the engineering educators are alert and competent. They will turn out the products needed, for present and future markets in the world of engineering enterprise.

For Low-Cost, High-Quality Service

Distribution investment today represents a sizable share of all utility plant investment. An irreducible minimum of the distribution outlay has to do with strength and safety and with standards of construction, self-imposed and laid down by regulatory authorities. But a controllable portion has to do with establishment and maintenance of an acceptable quality of service rendered to the consumer. In the last analysis this quality of service has only two elements in it. One element is continuity and reliability of that service. The other element is solely a matter of voltage. Continuity through storms and emergencies has been getting vigorous attention. Voltage regulation is entitled to a corresponding amount of attention, but it has not been getting it to the same fundamental, comprehensive and thorough degree as has the continuity aspect.

Practically all circuits are equipped with induction regulators, some at the substations, some with the pole-type out on the longer feeders. Feedbacks have been put in at load centers, copper has been enlarged, boosters and auto-transformers have been installed on tag-ends. Lower impedance transformers are being given consideration. In spite of all this methodical planning and improvising the sudden voltage dips persist because none of these measures is inherently neutralizing in nature or fast enough in action to head off the voltage dip as it occurs. Public Service Electric & Gas Company had most of these devices functioning in a particularly affected area, but found that series capacitors were the only feasible solution.

Series capacitors are a startling innovation for distribution circuits. To have the whole energy of a feeder circuit propagated through the dielectric of a condenser is foreign to the thinking of most of us. But there is bound to be more of this practice merely because it offers a direct way of offsetting the line reactance (and even part of the resistance) which the lagging motor starting current brings into prominence as a factor in voltage drop.

There will have to be the test of time as to durability, short-circuit performance, etc., before one can say that series capacitors will supplant the other forms of voltage regulation. Nevertheless, the successful performance related elsewhere in this issue does justify a broad recommendation. That is, that the advent of the series capacitor for distribution circuits gives an excellent provocation to analyze voltage regulation technique critically. Fundamental and painstaking attack on distribution is the way to annihilation of the bugaboo of the high cost of good service.

Management to the Fore

One criticism of the utility holding company has been that it has too often relegated competent and practical operating management into a background of relative impotence. Without a doubt some of the grief of the industry can be traced to the loss intimately at the counsel table of the advice of those who knew their territory, its quirks, its temperament and its potentialities. Of course their counsel was sought and heeded by the upper board, but interpretation inevitably suffered in the long-range translation into action. When, therefore, one of the large holding companies announces a reversal of current policy and places the presidents and managers of its subsidiaries on its board in place of those who shared in the direction of its financial integration it is surely making a commendable move.

It is particularly significant that Commonwealth & Southern should have been the one to do this in such positive manner. Three of its subsidiaries are in direct contact with the government project in Tennessee. Wendell L. Willkie, president of the holding company, has done a masterful job of negotiation with the T.V.A. to preserve as equitable an arrangement as possible in the area of public vs. private experimentation. With those now on its board who have to administer the details of co-operative activity with the government, as well as the far more absorbing task of keeping their properties functioning profitably and acceptably to the public, some gradual changes in policy may be anticipated.

This move in giving long-deserved recognition and participation to Messrs. Arkwright, Guild, Karn and Wallace partially exemplifies one school of thought about solving the holding company problem. It would see them unify and harmonize the administration of the local properties, with the customer phase given precedence over the financial phase. This decision will be watched closely by the industry to compare the results with such other units as move in the opposite direction, namely, establishment of the holding company as an investment trust, with full autonomy and freedom reposing in the operating properties.

Fair Play in Indiana

New Law Equalizes Taxes, Develops Regional Rates and Places Regulation on the Same Basis for Commercial and Municipal Plants. Result of One Year's Operation in Fact and in Opinions.

Governor Paul V. McNutt Who Sponsored New Law

By W. A. LAYMAN
Chicago, Ill.

THE new Indiana utility act, embodying a number of important innovations in state regulation, has been in operation approximately one year. The results have been most interesting, not alone from a local point of view, but from a national as well. For the purpose of appraising these results accurately, the writer sought personal interviews with some of the parties in chief interest on the diverse sides of the situation, including Gov. Paul V. McNutt, who sponsored the act as a vital part of his administration program; the chairman of the state tax commission, whose duty it is to assess the new tax on municipally owned utilities; the president of the State League of Municipalities, who isn't entirely satisfied with the act; private utility executives, and attorneys who have made a study of the act. Before voicing the views of these gentlemen, the vital elements of the act as of special significance are set forth in condensed form as follows:

1. *For the first time in any state of the union,* state, county and township taxes are assessed against municipally owned utilities (including electric, gas and water) on the same basis as against privately owned utilities, *on that portion of the municipal investment devoted to commercial service.*

2. Municipally owned utility rates for commercial service are under the same degree of state commission control as rates of privately owned utilities, unless that control is withdrawn by popular vote of the individual municipality objecting to this control.

3. Rate making has been greatly simplified and expedited, for both commission and utility, by establishment of the principle of class uniformity of rates in "regional districts," such districts being defined as "a single municipality and/or two or more municipalities and/or the adjacent and/or intervening rural territory."

4. Pending final adjudication of appeals, if any, against commission rate orders, the utility may continue the old rate or the new, whichever is higher, until final decree, with proper rebate if decree requires adjustment to lower level.

5. The burden of proof of "necessity and convenience" lies strongly on the municipality seeking to build or buy a utility property.

6. The creation of the position of "public counselor" (as in Maryland for some years) to represent the public before the utility commission in prosecuting rate or other public petitions.

7. Comprehensive provisions for bringing "affiliated interests" before the commission, including "every corporation or individual actually exercising any substantial interest or influence over the policies and actions of the operating utility under inquiry."

8. Municipalities must finance utility investments hereafter exterior to general community credit, and general taxes may not be employed for supporting the utility. Rates must provide for all operating costs, depreciation and amortization, interest, extensions, etc., although the municipality may provide one-third the initial cost, if necessary in financing (this one-third representing the usual common stock equity with private utilities).

Governor McNutt's estimate of results

"What was the prime consideration behind this new act, and what are the results as you see them?" Gov. Paul V. McNutt was asked.

"The old law and its administration were very unsatisfactory," he answered. "In my message to the last General Assembly I suggested four amendments to the laws regulating utilities:

1. That municipalities be given the following powers: To construct and acquire (by condemnation or otherwise), own or lease, and operate public utilities, without interference by the commission; to issue bonds or other evidences of indebtedness against municipally owned utilities, to be paid from earnings and profits arising from the operations of such utilities and not to be treated as an obligation of the municipality.

2. That municipally owned utilities be subject to township, county and state taxes, but exempt from municipal taxes.

3. That the question whether a municipality shall construct, acquire or lease a public utility be determined by a special election called for that purpose.

4. That the public service commission be given the necessary jurisdiction over holding companies and affiliated interests.

"Also, that the old commission be abolished and a new commission of but three instead of five members be created, and that the office of public counselor be created. As to results, I should say they have been satisfactory. There was obvious necessity for some reform in utility regulation. The new commission has been able to handle more business, and has already effected reductions aggregating $3,000,000 in rates, and we are by no means through. The taxation feature has not been seriously objected to by those cities already having plants, and this, as other provisions affecting municipal ownership, has merely contemplated putting these utilities on a fair business basis in relation to the state and to competitive private utilities. Inflated utility values cannot be recognized by the state in determining fair service rates, and improper service or other charges by affiliates, or improper control of operating policies by them, must be eliminated. But we contemplate fair treatment of private utilities based on sound property values, and also

fair competition for them, based on sound business principles, from municipally owned utilities."

"Have there been new municipally owned plants established since the law became operative?"

"So far as I know, none. Several towns have voted for plants, but either from difficulty in financing, or because 'convenience and necessity' have not been established in the state courts, when opposed by private utilities, these projects have not gone forward."

"Do you think the law tends to discourage municipal ownership?"

"I rather think so, in view of the expectation that regulation of rates under the new commission will give relief where rates are shown to be excessive."

"So far as your information goes, how do the rates of private utilities compare with those of existing municipal plants?"

"There is undoubtedly considerable variation in private rates. In some places private rates are lower than municipal rates. My impression, on the whole, is that the new law will correct abuses from which the state has suffered, permit the creation of municipally owned utilities where communities clearly establish a sound business necessity or usefulness, and quiet much of the irritation with respect to utilities which has prevailed up to the present time."

Assessing the new taxation

MOST immediate of problems in administration of the new law has been the determination of values for the assessment of 1934 taxes upon municipally owned utilities. This task was completed quite recently by the state Tax Commission, and notice of the assessment was sent out to the municipalities during the week of May 27-June 3. Municipalities have right of appeal at the July 3-12 session of the tax commission, but if appeal is not then made the original assessment stands. Of the 260 municipalities in the state owning utility properties giving commercial service, 45 operate electric plants. Voluntary returns to the commission were made by 220 municipalities. The remaining 40 were assessed on the basis of their questionnaire reports to the state utility commission. The total assessed value on these municipal properties, being the estimated proportion of the investment devoted to commercial service, for the year 1934, is approximately $25,000,000, and the assessed tax thereon will be about $150,000. The total assessed value for 1933 upon privately owned water, gas and electric properties was $229,239,421. The explanation of the relatively small total assessment against municipal plants lies in the fact that, generally speaking, municipally owned utilities are located in the small towns of the state. Commenting upon the difficulties of making the assessment, Philip Zoercher, chairman of the state tax commission (who has served the state a good many years in that capacity and enjoys a wide reputation for careful, fair discharge of responsibilities), said:

"Some of the municipalities in filing their returns failed to answer any question. In these cases we based our assessment on data secured from the state utility commission. While the law gives us the right to go into the communities and determine proper values for assessment, we resorted to this expedient in one instance only. In that case the mayor of the town appeared and stated that he had no figures on plant values. So we sent our engineer and secretary to investigate, and found that the city had a complete record of the investment in the public plant. I think we will be able to solve this assessment problem in a satisfactory manner. It is my opinion that the legislature had a perfect right to provide for state and county taxes on that part of the municipally owned utility that is not strictly for municipal needs but is used for supplying the public, for to that extent the utility is in the commercial business."

Activities of the state municipal league

THERE is an active league of municipalities in Indiana. Dr. Thomas L. Cooksey, a practicing physician and mayor of Crawfordsville, is president. This league has been taking an aggressive part in the state utility legislative situation, seeking a curtailment of the powers of the state utility commission and promoting actively the establishment of municipally owned plants. The league has a membership of 270 cities and towns which own all or a part of their gas, electric and water plants. The league as such did not appear before the last legislature, but its more aggressive members organized an independent body called the Municipal Rights League, and that body prepared a bill which it sought diligently to have enacted as a substitute for the old utility act. This bill naturally was strongly opposed by the privately owned utilities, with the compromise result that the act as finally passed embodied substantially the reforms advocated by the Governor. Asked his views as to the present utility law, Dr. Cooksey said:

"The present law is an improvement on the old, but we are not satisfied with it. It does not go far enough in protecting municipalities, and we will go before the next session of the legislature and seek its amendment to meet our views. The creation of the position of public counselor is an improvement. We do not ask for the abolition of the commission, and have no special criticism to make of the present body. We are opposed to the tax feature, and regard the segregation of values for tax purposes as impractical. We think the act unconstitutional and have engaged Frank Daily and Frank Sims, Indianapolis attorneys, to contest the law in the courts."

Dr. Cooksey cites the municipal electric plant of his own city as a shining example of the value to the municipality of utility ownership. Crawfordsville established its electric plant (gas and water plants are still privately owned) in 1890. The property now has a gross vaue of approximately $1,000,000. Its bond issues have been retired except as to $22,000 still outstanding, and these remaining bonds have been called for payment, but cannot be located. The plant made operating profits in 1930 of $127,603, in 1931 of $94,818, in 1933 of $78,000. The city spent $55,000 on plant rehabilitation and improvements three years ago, and still has a replacal and depreciation fund of $89,000 in bank. In recent years there has been appropriated from plant funds, for general municipal purposes, the following sums: $125,000 for a new city hall, $63,000 for the community chest, $40,000 for street improvements, $10,000 for new fire apparatus, $1,000 for the local band, and recently there has been authorized an appropriation of $24,000 to purchase the historic mansion and grounds of Senator Layne, this estate to constitute a local shrine.

In view of this financial record, indicative of careful management and freedom from political misuse, the rate schedules now prevailing are of interest, as follows:

Lighting rates

First	200 kw.-hr. at	6 cents per kilowatt-hour
Next	100 kw.-hr. at	5 cents per kilowatt-hour
Next	100 kw.-hr. at	4 cents per kilowatt-hour
All over	400 kw.-hr. at	3 cents per kilowatt-hour

10 per cent discount allowed if paid before 10th of month.
Minimum charge 50 cents per month.

Heating and cooking rate

First	50 kw.-hr.	2.5 cents per kilowatt-hour
All over	50 kw.-hr.	2 cents per kilowatt-hour

No discount allowed.

Minimum charge $1 per month. This rate granted on a connected load of not less than 1,000 watts of heating and cooking appliances. Domestic power appliances may be wired on this rate, providing the connected heating or cooking load is not less than 5,000 watts.

Power rates

First	100 kw.-hr.	4.0 cents per kilowatt-hour
Next	400 kw.-hr.	3.2 cents per kilowatt-hour
Next	500 kw.-hr.	2.7 cents per kilowatt-hour
Next	1,000 kw.-hr.	2.2 cents per kilowatt-hour
Next	5,000 kw.-hr.	1.75 cents per kilowatt-hour
Next	5,000 kw.-hr.	1.5 cents per kilowatt-hour
Next	7,500 kw.-hr.	1.4 cents per kilowatt-hour
Next	20,000 kw.-hr.	1.37 cents per kilowatt-hour
Next	20,000 kw.-hr.	1.32 cents per kilowatt-hour
Next	22,500 kw.-hr.	1.25 cents per kilowatt-hour

10 per cent discount allowed if paid before 10th of month. All over 82,000 kw.-hr. 0.0125 cent per kilowatt-hour net basic rate.

Minimum charge 50 cents for each horsepower connected up to and including ten, 25 cents for each additional horsepower over ten.

This rate granted only on connected motor loads of 1 hp. and larger, excepting when a motor less than 1 hp. is automatically controlled, such as electric refrigerator, furnace or pump motors.

Two accessible outlets will be allowed on a power service in each residence, for household appliances.

Minimum charge 50 cents per month per outlet in addition to the horsepower minimum charge.

Rate schedules have been reduced, from time to time, as the plant prospered financially, but the state commission evidently regards the present rates as low enough for safety under existing conditions, as an application to reduce them further was denied by the present state commission. Taking a cue from the practices of the private utilities, the Municipal League, according to Dr. Cooksey, proposes to effect a comprehensive group of state and county committees, for co-operative development in operating technique, accounting, legal procedure and other aspects of the business calling for expert personnel and protection of local interests. It is their intention, he says, to keep abreast of the times, and through organization avoid defaults on matters of vital interest.

The private utility point of view

IN GENERAL the private utilities seem to feel that the present act is probably as good as could be expected under the circumstances, being, obviously, a compromise measure between their desires and the extreme proposals of the aggressive advocates of municipal ownership. Morse Dell Plain, president of the Northern Indiana Public Service Company, expressed the view that if the law was administered equitably it would prove workable, and he anticipated little difficulty in securing protection for his business. While the company's experience under the old law was, in general, satisfactory, yet agitation for municipal ownership growing out of activity on the part of some selfish interests, together with encouragement of municipal ownership from Washington, made revision of the law inevitable. The present amendments represent material concessions to municipal advocates, but with some counter features of value to the private utilities. He stressed the great value of the regional rate provision as tremendously simplifying accounting and expediting rate adjustments and desirable leveling of district rates. The tax on municipal plants was a very timely recognition of the principle of equalizing taxes with privately owned plants, though the private industry feels equalization should go all the way in equity and tax the entire investment of municipal utilities. Some features of the law will prove impractical, he felt, but does not doubt these will be remedied. The permission to municipal plants to extend operations 6 miles beyond their limits he regards as very unwise, leading to overlapping in an unfortunate way between municipalities and also between private utilities and municipalities. The requirement that in all future orders of the commission authorizing the issuance of utility securities a common stock equity of at least 25 per cent of the utility's total securities shall be maintained, he considered unworkable if construed as a condition limiting the power of the commission to authorize the refunding of bonds now outstanding, since many utilities, though able to refund their present bonds, may find it impossible to market additional common stock. The provision for control of municipal plant rates by the state commission, and the limitation of municipal ventures to fully proven convenience and necessity, are features he regards as fair to all parties and should demonstrate their wisdom and usefulness as time goes on.

Some difficulties facing new municipal ventures

TWO difficulties very clearly face municipalities in new ventures into utility ownership under the new law. The provision that "necessity and convenience" be clearly shown is operating to discourage mere political enthusiasm for public ownership. The economic wisdom of such ventures must be clearly established. As an example, the case of the village of Chesterton, Porter County, may be cited. As the initial steps looking to establishment of a city plant, the town board passed the necessary resolution and the people gave approval by a majority vote. This took the question entirely out of the hands of the state commission, as the law intended. But the private utility serving the town carried the matter into the Porter Circuit Court, and a sweeping decision was handed down sustaining the opposition of the private utility, citing these grounds for the denial:

> That the evidence clearly disclosed adequate and sufficient service by the private utility; that the town had not made application for reduction of rates during the last six years; did not have adequate and accurate information as to the cost of constructing a plant and acquiring the privately owned lines; did not have adequate information as to costs of operation; that there was no definite plan for financing a municipal plant nor of managing it, nor any definite information as to proper rates to be charged, and that public convenience and necessity did not require the construction of a municipal plant.

Although the town had a right of appeal to the state Supreme Court, no appeal was made, and the costs of the suit were assessed against it.

The city of Muncie has endeavored to acquire the privately owned plant serving it, as also service lines within a 6-mile limit outside its boundaries, but has been enjoined by the court on the ground that great damage would result to the private utility in taking from it the plant which not only serves the local district but also serves wide territory beyond the city's jurisdiction. Other municipalities entertaining ownership ambitions

have found the financing impossible, the assumption that the Federal Public Works Administration would supply a substantial part of the funds having proved illusive.

General aspects in review

All in all, it is clear that the new act does not fully satisfy any of the chief parties in interest, but it is also clear that as a compromise measure it is a distinct step forward in meeting the economic and political exigencies of the times. Undoubtedly the new law calls for municipal ownership and operation on a better business basis than heretofore existing. Plants must finance themselves, may not establish rates for the purpose of indirect taxation of the people, are considered business ventures, as they should be when they give commercial service, and are protected from political manipulation to a new degree. It is significant that not a single municipality of the 270 owning utilities has voted to withdraw rate control from the state commission. Nor is the "affiliate" provision of the law regarded with serious objection by the private utilities. There is likely to be controversy over plant evaluations, both for rate-making purposes and for property transfer from private to municipal hands. "Good will" values are eliminated from the law, with some confusion and contradiction of language, and land values are to be appraised at tax assessment values.

In conversations with the Governor and state officials, there seems evident a desire to combine, in spirit, both a "New Deal" and a "Square Deal"; to make procedure less cumbersome; to meet the holding company issue squarely in so far as prohibiting improper operating and capital charges upon consumers, and to quiet utility clamor by expediting consideration of reasonable public complaints. It is true that the new law opens the door in some measure to political administration, as control of utility commission membership is entirely in the hands of the governor, and the public counselor* is open to the temptation of using his key position to further political ambitions. But there has been no complaint, to date, of any misdirection of administration, and there seems to be general confidence that present executives intend to give unbiased consideration to all questions coming before them under the law.

There is great clamor for rate reductions, and the private utilities will have their backs against the wall combating this. But with the disclosure, upon calm study, that many local plants are now making higher rates than the private utilities, and with the regional adjustment and simplifying of rates the private utilities seem to desire to make voluntarily, it is contemplated that rate clamor will diminish, especially as it is realized that federal funds are not pouring freely into local municipal utility investment and that the President does not advocate general municipal ownership.

The present public counselor, Sherman Minton, is a candidate at this time for the Democratic nomination for United States Senator. He is an attorney of high standing and wide popularity, and his integrity in the proper discharge of his official duties has not been seriously questioned.

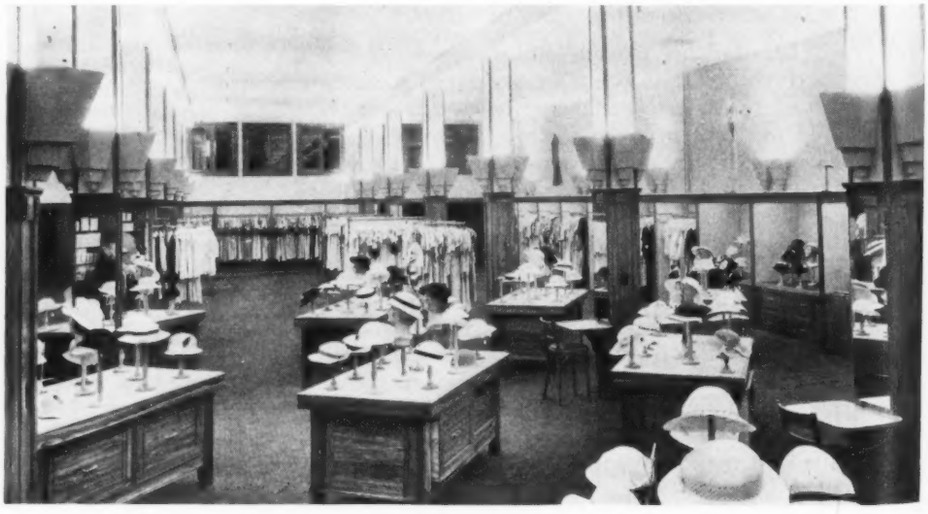
Two-Filament Lamps in New Department Store

By L. C. TWICHELL
Engineer Rochester Gas & Electric Corporation

Interesting use is made of the new double-filament lamps in an indirect lighting system in Rochester. The Lincoln Stores of Quincy, Mass., have just opened a junior department store here. They desired to get the effect of a high ceiling and accomplished it by installing mirrored glass reflectors, in sheet-metal urns, around the columns and along the walls, mounting the new lamp with both 200- and 300-watt filaments. This provides a maximum of 500 watts per lamp. The columns are spaced 19x23 ft. With 500 watts per unit in use the initial measured average intensity was 38 foot-candles. The ceiling height is a little over 14 ft. and finished in flat white.

In the rear of the store the same lighting system is used, although, due to the smaller size of bays ($13\frac{1}{2}$x $16\frac{1}{2}$ ft.), 200-watt lamps and reflectors are installed. Provision is made in the wiring and switches for the future use of the 350-watt, three-light lamp. The initial measured average with the 200-watt lamps was 38 foot-candles.

In addition to the high intensity and the uniform distribution of light over the sales area, a great advantage of this installation is the cheery atmosphere created as viewed from both within and without the store. Due to the absence of glare, one is not directly conscious of the lighting intensity, but its effect on the appearance of the merchandise is inescapable. The store opened on May 26 and has attracted a large number of patrons. The general comment is that the intense illumination is "just like daylight."



New double-filament lamp used for indirect illumination in a Rochester department store

Service Records of Diesel Plants

By JAY SAMUEL HARTT
Consulting Engineer, Madison, Wis.

An Analysis of 87 Municipal Utilities in Wisconsin Provides Some Interesting Experience

WITH the availability of Public Works Administration funds for that purpose, there has become apparent among municipal utilities a disposition to install Diesel oil engines in replacement of present arrangements for the wholesale purchase of electricity. In recognition of this trend the writer made a study of reports filed with the Public Service Commission of Wisconsin to determine the relative costs of purchased power and of Diesel engine generation for 1933 in that state. This study reveals that purchase of power in general is the less costly of the two methods of energy supply and that too frequently the Diesel plant is so deficient in capacity as to afford no assurance of service continuity in the event of failure of a major unit.

On January 1, 1934, there were 87 municipal utilities in Wisconsin. Their electrical energy was obtained as follows:

60 purchased all energy from private utilities.
9 generated all energy by Diesel engines.
6 purchased part and generated part by hydro-electric plants.
5 generated part by Diesel engines and part by hydro-electric plants.
4 generated all energy by steam plants.
1 purchased part and generated part by a steam plant.
1 generated part by Diesel engines and part by a steam plant.
1 generated all by a hydro-electric plant.

87 Total

From this it is evident that purchased energy was used by most of the municipal utilities. It is also evident that Diesel oil engine plants were used by the majority of those generating their own energy. Of the fifteen municipal plants using Diesel oil engines, ten plants generated sufficient energy to be of value in determining costs. There was also one privately owned Diesel oil engine plant in Wisconsin having sufficient output to make resultant costs dependable. That part of the study devoted to Diesel oil engine generating costs is based on these eleven plants. Table I shows the horsepower of the prime movers installed in the plants of each utility considered.

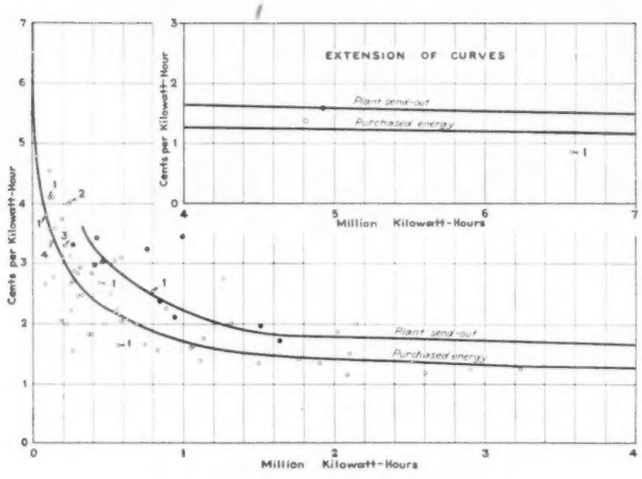
The cost comparison resulting from the study is shown in the accompanying graph of mean curves. The detail elements on which the Diesel plant cost curve was erected will be presented in a later article.* The kilowatt hours and the amounts paid therefor which determine the purchased power curve were taken from the records of the Public Service Commission. Reports filed by the private companies selling the energy were used in the majority of cases. Where this information was not available at the time of compiling reports filed by the municipalities were used. The private company data were considered preferable because municipal utilities frequently report data taken from paid invoices and therefore the information filed does not always cover the calendar year.

Considering first the Diesel oil engine costs, it must be pointed out that this curve reflects only the actual results for Wisconsin plants in 1933. In using these data for specific applications, adjustments should be made for local and prevailing conditions. Important among these are the adjustments for proper installed capacities, actual operating crews, local labor rates, fuel and lubricating oil costs, fuel and lubricating oil efficiences for the running plant capacity factors, methods of obtaining cooling water, maintenance costs over the life of the equipment, local insurance rates, and possible adjustments of fixed costs.

In considering the purchased power curve, wide variations in costs for relative amounts of energy are apparent. This is due to many factors. A detailed analysis would be required of each contract to determine the reasons for these differences. The major factors affecting the costs of purchased energy are the load factors of municipal utilities, the costs of generation in plants from which power is obtained, the costs of transmission line extensions to reach the utilities, standby and surplus power features of the contracts, and many others.

To determine the relative costs and service values of purchased power and Diesel-generated operations, the author surveyed the 1933 reports of the Public Service Commission of Wisconsin. This article, and one to follow, offer a comprehensive study. It is found that many of these isolated plants are of insufficient capacity to provide completely dependable service.

*"*What Electricity Costs in Municipal Diesel Plants," to be published in a subsequent issue.*



Cost of electricity—
Wholesale purchase vs. Diesel generation

On this graph are spotted the 1933 unit costs of electricity for municipal systems in Wisconsin. The solid lettered circles are for systems that depend wholly or largely on Diesel generation. The letters refer to identifications in the tables. Of the open circles, which designate the systems that buy on wholesale contracts, some are numbered in reference to the following notes:

1. Utility generates part of energy requirements in municipal hydro-electric plant.
2. Utility purchased by municipality June 1, 1933. Increased to annual basis for comparative purposes.
3. All energy requirements generated in municipal Diesel oil engine plant after June 24, 1933. Increased to annual basis for comparative purposes.
4. All energy requirements generated in municipal Diesel oil engine plant after December 31, 1933.

The purchased power curve, like the oil engine curve, reflects only the actual 1933 results for Wisconsin plants as reported to the commission.

In designing a power plant it is considered good engineering to choose generating units of such size that the largest unit can be down for repairs during the time of the peak load on the plant without causing curtailment of service. This is a prerequisite to assure continuity of service. To test the adequacy of the respective plants on this basis Table II was prepared. The kilowatt capacities of all generating units shown in Table I were computed according to the method prescribed by the American Society of Mechanical Engineers for oil engines (horsepower of prime mover $\times 0.746 \times 0.90$). An inspection of Table II reveals that:

1. Six of the ten municipal plants were under-installed in capacity.
2. Three of the ten municipal plants had a very small margin of safety in installed capacity.
3. Only one of the ten municipal plants had a reasonable margin of safety in installed oil-engine generating capacity.
4. The privately owned utility had a 124 per cent margin of safety in installed capacity. (This is accounted for by the unreliability of the hydro-electric plants during system peaks.)

In every plant under review the largest unit was a Diesel oil engine. This unit may easily be down for repair during the time of peak load. As a general rule in Wisconsin stream flow is low during the annual sys-

Table I—Horsepower of Prime Movers Installed

Designation of Utility	Diesel Oil Engines	Steam Engines and Turbines	Water Turbines	Total Installed Horsepower
A	3,600	...	....	3,600
B	1,050	150	....	1,200
C	1,650	600	2,250	4,500
D	1,200	...	....	1,200
E	800	...	500	1,300
F	600	...	....	600
G	1,080	...	235	1,315
H	360	...	....	360
I	600	...	....	600
J	300	...	....	300
K	210	...	....	210
Total	11,450	750	2,985	15,185

Table II—Adequacy of Plant Capacity in Kilowatts

Designation of Utility	No. of Plant Units	Total Capacity of Plant Units	Peak Load Capacity of Largest Unit	Peak Load Carrying Capacity of Plant	Peak Load of Utility	Excess Capacity	Deficit in Capacity
A	4	2,417	806	1,611	1,370	241	...
B	4	806	282	524	515	9	...
C*	10	3,021	604	2,417†	1,081	1,336	...
D	2	806	504	302‡	800	...	498
E	4	873	403	470	450	20	...
F	2	403	242	161	265	...	104
G	5	883	403	480	450	30	...
H	2	242	161	81	145	...	64
I	3	403	242	161	175	...	14
J	2	201	121	80	100	...	20
K	2	141	94	47	85	...	38

* Privately owned utility. † Demand 1932. ‡ Demand 1930.

Table III—Kilowatt-Hours Generated

Designation of Utility	By Diesel Oil Engines	By Other Prime Movers	Total Kw.-Hr. Generated	Per Cent of Total by Diesel Oil Engines
A	5,238,400	.....	5,238,400	100
B	1,730,300	19,040	1,749,340	99
C*	1,607,200	1,161,800	2,769,000	58
D	1,055,600	.....	1,055,600	100
E	1,002,400	393,730	1,396,130	72
F	913,700	.....	913,700	100
G	834,050	316,700	1,150,750	72
H	497,685	.....	497,685	100
I	452,100	.....	452,100	100
J	438,000	.....	438,000	100
K	149,600	109,150†	258,750	58
Total	13,919,035	2,000,420	15,919,455	87

* Privately owned utility.
† All power purchased until June 24, all power generated by Diesel oil engine plant thereafter.

Table IV—Age of Diesel Oil Engine Equipment

Plant Designation	Make of Engines	Year Installed	Number of Engines Detail	Number of Engines Total	Hp. of Engines Detail	Hp. of Engines Total
A	Busch-Sulzer.....	1924	1		600	
	McIntosh & Seymour	1926	1		600	
	McIntosh & Seymour	1929	1		1,200	
	McIntosh & Seymour	1930	1	4	1,200	3,600
B	Fairbanks-Morse.....	1931	1		210	
	Fairbanks-Morse.....	1931	2	3	420	1,050
C	Bessemer.....	1926	1		750	
	Cooper-Bessemer....	1931	1	2	900	1,650
D	Nordberg.....	1926	1		450	
	Nordberg.....	1928	1	2	750	1,200
E	De La Vergne.....	1923	1		200	
	Nordberg.....	1929	1	2	600	800
F	Fairbanks-Morse.....	1931	1		240	
	Fairbanks-Morse.....	1931	1	2	360	600
G	Fairbanks-Morse.....	1926	1		240	
	Fairbanks-Morse.....	1927	1		240	
	Fairbanks-Morse.....	1930	1	3	600	1,080
H	Fairbanks-Morse.....	1930	1		120	
	Fairbanks-Morse.....	1930	1	2	240	360
I	Fairbanks-Morse.....	1927	2		120	
	Fairbanks-Morse.....	1930	1	3	360	600
J	Fairbanks-Morse.....	1931	1		120	
	Fairbanks-Morse.....	1931	1	2	180	300
K	Fairbanks-Morse.....	1933	1		70	
	Fairbanks-Morse.....	1933	1	2	140	210

tem peak, which is usually in the winter months. This makes it even more necessary to have adequate Diesel standby capacity in combined Diesel and hydro-electric plants.

From this table two conclusions can be drawn, viz.:

1. That only two Diesel oil engine plants had sufficient installed capacity to assure continuity of service.

2. That if adequate equipment were installed the additional fixed charges would increase plant output costs.

Relevant to this matter of adequate—more properly, inadequate—peak capacity is the extent of dependence on their Diesel engines by the eleven utilities considered in this discussion. To show this dependence Table III was prepared. This table sets forth the kilowatt-hours generated by Diesel oil engines, the kilowatt-hours generated by other prime movers and the per cent that engine generation bears to total generation for the year 1933. It is apparent that Diesel generation was used as the major source of energy for each utility. The units should therefore be of sufficient capacity to assure adequate service under all conditions.

The seriousness of this matter of peak capacity has evidently not yet been appreciated, nor its full force been felt on account of the fact that average age of the 27 engines concerned is only five years. As is shown in Table IV, ten engines were 0 to 3 years old, seven 3 to 5 years, eight 5 to 8 years and only two over 8 years, with the oldest less than 11 years. Wear and tear have hardly had time to make themselves apparent.

The obvious conclusion to be drawn from the study is that during the year 1933 the average costs of electrical energy purchased at wholesale were substantially lower than those for energy generated by Diesel oil engines. Manifestly, the differential in costs would be greater if adjustments were made to the oil engine costs for adequate installed plant capacity and for proper maintenance charges distributed over the life of the equipment.

Sleeve Connectors Show 90-100% Conductor Strength

By C. C. CORNELIUS
Kansas City Power & Light Company, Kansas City, Mo.

Twisted sleeves are more easily installed than the compression splices and are therefore cheaper in first cost. Sleeve connections have proved to be satisfactory joints on both copper and aluminum conductors. Twisted sleeves will not develop the full strength of the conductors; however, if they are properly installed between 90 and 100 per cent of the strength seems to be the average obtained, as shown in the accompanying tables. Copper sleeves have proved very successful from a weathering standpoint, principally due to the stable and non-corrosive nature of copper.

Sleeves for splicing aluminum or A.C.S.R. conductors must be applied with more caution. It is essential for best results that the proper size of sleeves be used and the correct number of twists made, and also provision made for the sealing of the joint from the weather. Owing to the great affinity of aluminum for oxygen and its less stable nature, corrosion and chemical action may result at current carrying joints unless they are sealed from the dirt and smoke, moisture or acid conditions of the air.

Table I—Test on Twisted Sleeve Joints A.C.S.R. with Corrosion Resistant Compound in the Joint

Two Sleeves per Test

Test No.	Wire Size	Twists in Sleeve	Aluminum Failed	Steel Failed	Ultimate Strength of Wire
1*	4	3½	1,372	1,208	1,665
2*	2	3½	2,455	1,917	2,660
3*	2/0	3½	4,300	3,520	5,300
4*	4	4	1,486	1,208	1,665
5*	2	4	2,590	1,945	2,660
6*	2/0	4	3,875	3,570	5,300
7†	2/0	4½	5,225	3,530	5,300
8†	2/0	4½	5,120	Pulled out of holder	5,300
9†	2/0	4	5,590	3,540	5,300

*Tension in the aluminum and steel brought up together. After aluminum failed the steel core failed at tension shown. All wires failed near bell end of joint.

†Steel stressed initially to 3,060 lb., in test No. 7, to 2,590 lb., in test No. 8 and to 3,225 in test No. 9; from there tension in aluminum and steel brought up together. Sleeves were twisted in thirds beginning at inner end and working out.

Table II—Tests on Twisted Copper Sleeves

Results of vibration test on No. 4, No. 6 and No. 8 Memco splicing sleeves using solid annealed t.b.w.p. cu. Each sleeve and wire was put under tension and carrying current was vibrated at 60 cycles per second with amplitude of from ⅛ in. to ¼ in. for 2,880 hours.

Size Sleeve	Pounds Tension	Current Amp.	Distance Between Bridge Supports—Ins.	Resistance of Sleeve* and 10-Ft. Section of Wire
8	125 lb.	50 amp.	17.5	0.00631 at 30 deg. C.
6	225 lb.	75 amp.	18.6	0.004166 at 30 deg. C.
4	550 lb.	75 amp.	20.4	0.00233 at 30 deg. C.

*Resistance measured same after test as before test was started.

Table III—Tensile Strength Test on Memco Copper Splicing Sleeves and Soldered Splices

Solid Annealed Copper Wire

Kind of Splice	Breaking Strength (Lb.)	Breaking Strength (Lb.) (Wire)
No. 4 Sleeve 4½ turns	1,075	1,200
No. 4 Memco 4 turns	945	....
No. 4 Twisted soldered splice (3 neck turns soldered — 3 end turns)	1,120	....
No. 6 Memco 4½ turns	727	760
No. 6 Memco 4 turns	685	....
No. 6 Twisted soldered splice (3 neck turns soldered— 3 end turns)	727	....
No. 8 Memco 4½ turns	480	480
No. 8 Memco 4 turns	450	....
No. 8 Twisted soldered splice (2½ neck turns soldered— 3 end turns)	440	....

All wires broke at bell end of sleeve or on the wire outside of joint.

A vibration test was run on Nos. 4, 6 and 8 Memco copper splicing sleeves, using solid annealed t.b.w.p. wire. Tension was applied to the wire and sleeve and current was kept on the wire; 50 amp. on No. 8, 75 amp. on No. 6 and 75 amp. on No. 4.

The wire and clamps were vibrated by electromagnets at 60 cycles per second at an amplitude of ⅛ in. to ¼ in. The vibration was allowed to continue for 2,880 hours.

No change could be noticed in the sleeves at the end of the test.

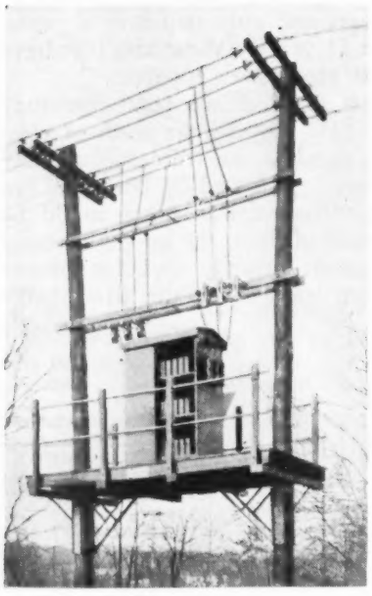
The resistance checked the same at the end as at the beginning of test.

Tensile test after vibration for 2,880 hours:

Wire	Ultimate Strength	Strength of Wire
No. 8	445— 445— 445	480
No. 6	705— 700— 700	760
No. 4	1,110—1,110—1,110	1,200

Why Not Series Capacitors for Distribution

A Logical and Successful Approach to the Problem of Voltage Regulation on Rural Circuits



This capacitor, constructed for the Public Service Electric & Gas Company by the General Electric Company, is rated at 375 kva., three phase, 60 cycles, 1,000 volts, for installation on a circuit operating at 4,156 volts. It is in a sheet metal housing (36 in. wide, 70 in. long and 92 in. high) with the units supported on angle iron racks. The units are arranged in three tiers with two rows per tier, each tier forming one phase and being separated from adjacent tiers by a sheet metal barrier. The three panels carrying the necessary protective equipment are mounted at one end of the housing, each panel being opposite the phase tier to which it is connected. The line leads enter and leave the housing through porcelain bushings on the ends.

THE series capacitor is an assembly of capacitance units connected in series with the conductor of a circuit, in contrast to the more commonly used shunt-connected capacitor for power-factor correction. A series capacitor carries the full line current at whatever point it is placed in a circuit and a voltage is built up across the unit which at all times is proportional to the load current flowing. This voltage is opposite to the voltage drop across an inductance, and consequently, by proper choice of a capacitor, it is possible to neutralize the voltage drop caused by the inductance of a circuit. It is not possible to neutralize the resistance voltage drop in an exactly similar manner, but by use of capacitance in excess of the amount required to neutralize the inductive voltage drop it is possible to obtain resistance voltage drop compensation.

To illustrate, let us assume a circuit having the following characteristics and then calculate the effect of various values of capacitance:

E_r = Load voltage = 2,400
R = Resistance (ohms) = 1
X_L = Inductive reactance (ohms) = 2
I = Load current (amperes) = 100
Power factor (per cent) = 80

Fig. 1a shows the schematic and vector diagrams of the assumed uncorrected circuit. Fig. 1b and 1c show these diagrams for series capacitor units of 2 and 4 ohms respectively.

Let us now take a specific circuit of the Public Service Electric & Gas Company's system for study and see how a series capacitor installation was applied to it. The general geographic arrangement of the circuit and the location of loads is shown in Fig. 2.

With the arrangements described in Fig. 2 the primary voltage diagram at present maximum load is shown in Fig. 3. The limits indicated are the primary voltages which must be maintained in order that consumers' voltages may be held within the limits prescribed by the state Board of Public Utility Commissioners. It will be noted that portions of the area could not be supplied at voltages within these limits.

In 1932 one of our customers made an installation of about a dozen three-phase motors ranging up to 7½ hp. in size at State Village, a distance of 8 miles from the substation. The normal allowable starting currents of these motors, which were used to drive the condensate pumps of a central heating plant, caused primary voltage dips of about 3 per cent at intervals of two minutes during all hours of the day and night, as indicated by the voltage charts shown in the illustration on page 943.

A preliminary investigation indicated that a series capacitor might aid in improving general voltage conditions and also cut down the effect of motor-starting currents. The first calculation was based on using a series capacitor of 5.35 ohms per phase, which approximately neutralized the inductive reactance between State Village and the substation. This also permitted circuit rearrangements. The dips under this plan were calculated to be approximately one-half the original value.

Similar calculations were made using a capacitor of 10 ohms per phase with a resultant reactance approximately

Capacitors have been used as series regulators on transmission lines; as for distribution, it apparently just could not be done. But Jersey has done it, avoided much heavier outlay for regulation and gained greatly improved voltage on a long, difficult rural-area feeder where refrigeration and farm loads have outstripped conventional regulators in speed of response. Flicker and dips are now under control. The series capacitor works while the induction regulator would be rousing itself.

Voltage dips from motor-starting currents are minimized by a series-capacitor installation

Feeders?

By C. L. DUDLEY . . E. H. SNYDER

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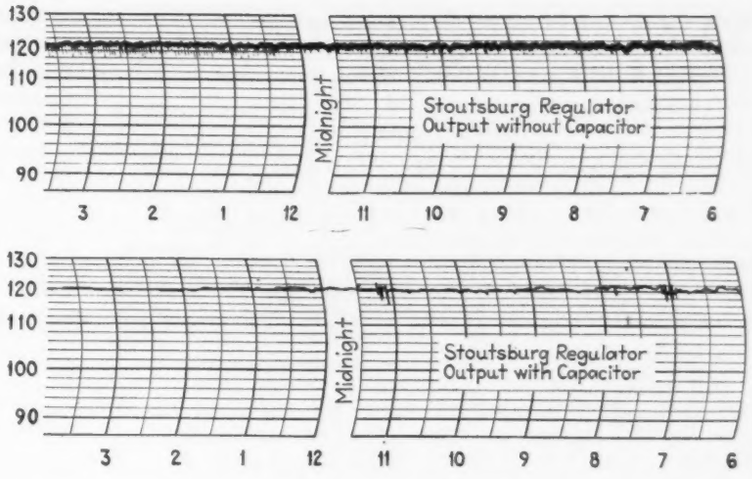


twice that of the inductive reactance of the line. The dip voltages were found to be approximately one-eighth of the uncorrected line values.

It was desired to be able to carry at least 125 amp. of load through the capacitor, however, and the 10-ohm unit was rated at only 97.5 amp. Consequently another calculation was made using an 8-ohm-per-phase capacitor of 125 amp. rating. The voltage diagram with this unit at the same loadings is shown in Fig. 4. The starting dip voltages are less than 1 volt, which is not considered objectionable. The voltage diagram for the circuit when loaded to the full capacity of the capacitor unit is given in Fig. 5. This shows an improved service condition for a 47 per cent greater load after the regulators at Stoutsburg are moved to Hopewell.

Comparative costs of various relief measures

Before the final decision to install series capacitors was made, several other methods of improving voltage conditions on the circuit were studied. The total load on the circuit amounted to about 700 kva. and, as indicated by Fig. 3, it was not possible to deliver satisfactory voltage to all customers even under steady load conditions. The largest portion of the existing load was located in the town of Hopewell (see Fig. 2) and it appeared probable that future load growth would be most rapid in that area. Therefore, any measures which were to be taken to reduce the voltage dips caused by the motor load at State Village should also increase the total capacity of the circuit to provide for a moderate amount of load growth.

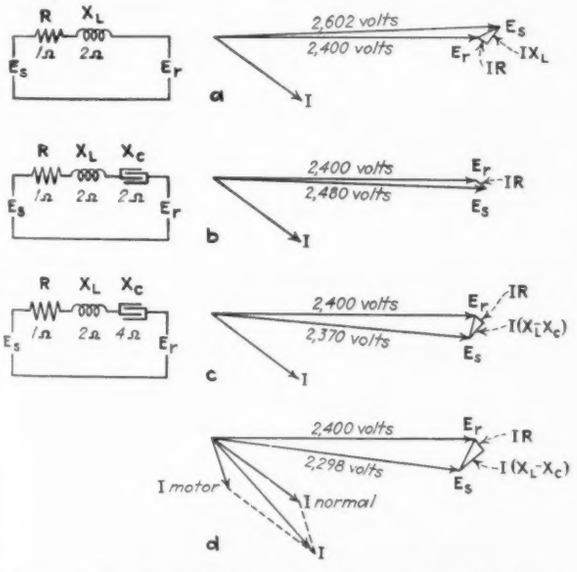


Fig. 1—Series capacitor neutralizes inductive drop and some of IR drop

(a) Uncorrected condition.
(b) and (c) Four-ohm capacitor in (c) corrects some of *IR* drop better than the two ohms in (b).
(d) Effect of changing power factor.

The first and most obvious solution to be considered was simply to construct a separate 4-kv. circuit from the substation over the same route to State Village to relieve the existing circuit of the troublesome motor load. This proposal would require the construction of 7 miles of line and the installation of a new feeder position with regulators at the substation, at a total cost of approximately $30,000. When it is considered that the total motor load to be taken over would be less than 150 kva. and that substantially the same voltage dips would be experienced on the new circuit, it is evident that this plan could not be justified economically.

Bearing in mind the eventual need for additional capacity at Hopewell, the construction of a small substation at this location was studied. This plan would require the construction of 5 miles of 26-kv. transmission circuit and the installation of a suburban type of step-down substation with regulators for one 4-kv. feeder. It was estimated that this scheme would cost at least $50,000, and in addition to the inordinate cost it also was undesirable from the operating standpoint because it would require connecting a long tap to an important transmission tie line.

As a modification of this plan the construction of the transmission line and its operation initially at 4-kv. was considered. While this scheme would eliminate the step-down transformer installation and thus reduce the cost somewhat, it was found by calculation that the starting current voltage dips on the circuit would not be reduced materially by the new method of feed.

It was estimated that a series-capacitor installation at Blawenburg, together with an additional set of regulators at Bolmer's Corner and attendant line changes, would cost $10,000. Since calculations indicated that voltage dips would be reduced to less than one-quarter of the existing values and that the over-all circuit capacity would be increased by more than 40 per cent, it was evident that the use of series capacitors, in theory

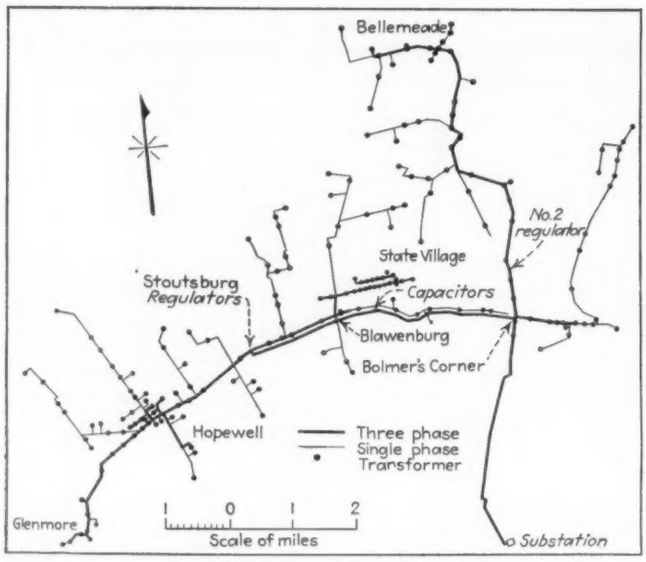


Fig. 2—Regulation difficult in this area until series capacitor was installed

The area includes one large and several small villages and considerable rural load. The circuit operates at 4,150 volts, three phase, four wire, with the neutral grounded at the substation only. Induction-type voltage regulators, single-phase units connected in star, are used at the substation. In order to keep down the voltage spread on the circuit feed-backs were constructed as shown. As the load increased the regulator units were reconnected from 10 to 20 per cent boost. Later it became necessary to install pole-type induction-voltage regulators at Stoutsburg further to improve voltage conditions.

at least, would fulfill all of the requirements for improvement of conditions in the area. The saving in cost indicated by this plan was great enough to outweigh any objections to the use of an untried piece of equipment.

Physical characteristics of series capacitors

The capacitor units used are similar to the familiar power-factor correction units in construction and appearance and they are insulated for full line voltage to ground. Their general appearance and method of mounting are shown on page 942.

Since the voltage across the capacitor is proportional to the current flowing through it, a fault on the load side of it will cause an abnormal voltage rise. This must be provided for either by designing the individual units for self-protection at high voltages or by using a protective scheme, which will automatically shunt out the units under such conditions and return it to operation when normal conditions are restored. Calculations showed the short-circuit current for a solid three-phase fault at the capacitor location at Blawenburg (see Fig. 2) to be 375 amp., and with the 8-ohm capacitor in service the current for a fault on the outgoing side of the capacitor was calculated to be 635 amp. This would result in a voltage across the terminals of 5,110.

It was decided that automatic protection would be preferable to self-protection. The automatic protection scheme chosen utilized a contactor to cut the unit in or out of service. The schematic diagram of the protective device is shown in Fig. 6.

To guard against operating with punctured insulation in one of the units, thus shunting all line current through it, the protective device is designed to short out the capacitor under this condition. For this purpose the units are arranged in two paralleled sections with a current transformer in each section. The current transformer secondaries are connected differentially so that an unbalance in current caused by a unit failure will set up a voltage and, by means of a trip coil, actuate a second contactor which will short out the capacitor. This contactor is, of course, a hand-reset affair.

Protection against lightning is afforded by installing lightning arresters from conductor to ground on each side of the capacitor. Since such a connection, in effect, puts two arresters in series across a high voltage 60-cycle source in case of line faults, the choice of arrester must be such that the valve action is not made inoperative.

This first capacitor installation has been in service for twelve months. Charts showing voltage conditions on the circuit before and after the installation are shown in the illustration on page 943. Fig. 7 shows the magnitude of voltage dips throughout the length of the circuit

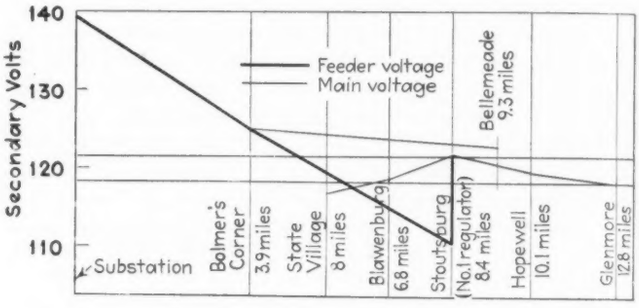


Fig. 3—Unsatisfactory regulation previous to installation of capacitors

For convenience in calculation the loads are considered grouped at approximate load centers. The total load on the 4,150-volt circuit was 95 amp. at 80 per cent power factor.

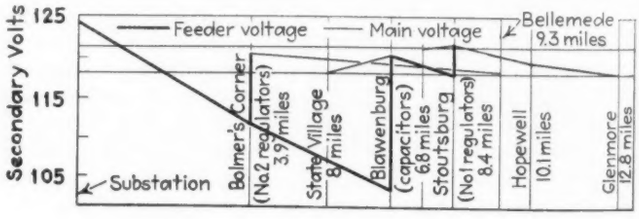


Fig. 4—Eight-ohm capacitor successfully bettered the regulation

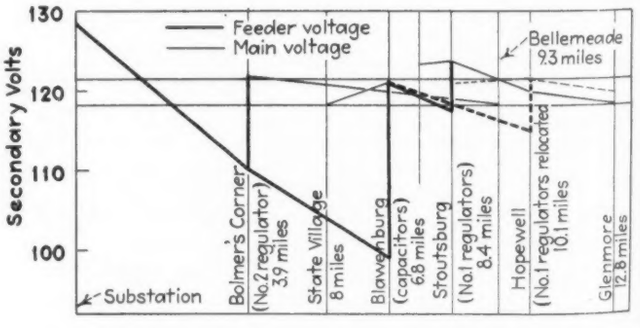
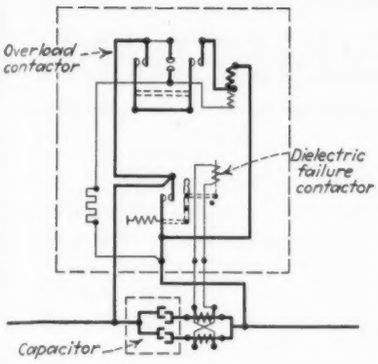


Fig. 5—Even with rated load on capacitor regulation is acceptable

Load is 140 amp. at 80 per cent p.f. The broken line indicates improved voltage obtained after moving No. 1 regulator from Stoutsburg to Hopewell.



A sphere gap is shunted across the terminals of the unit so that a voltage rise above a predetermined value, in this case 2,000 volts, will cause the gap to arc over. The circuit thus set up actuates the closing coil for the contactors in series across the capacitor. After the contacts are closed they are held in by the abnormal line current flowing. When this line current is reduced to normal value the contactors are released and the capacitor is replaced into the circuit.

Fig. 6—Capacitor protected against rise in voltage under fault condition

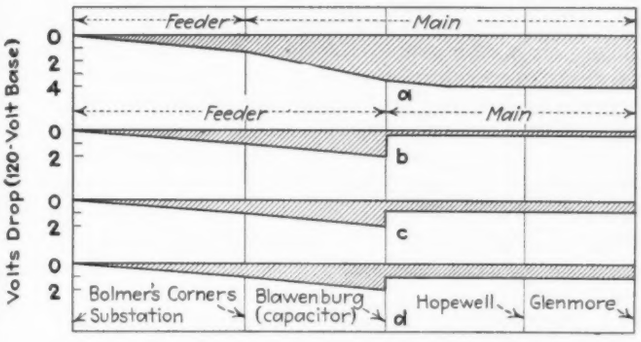


Fig. 7—Results verified preliminary calculations

(a) Actual dips caused by motor-starting currents before capacitors were installed.
(b) Calculated dips with 10-ohm capacitor.
(c) Calculated dips with 8-ohm capacitor.
(d) Actual dips with 8-ohm capacitor.

before the capacitor was installed, as calculated for the two sizes of capacitor considered and as actually found after the capacitor was installed. It is evident from the charts that the capacitor has practically eliminated the motor-starting current-voltage dips.

The results attained with this installation have been so successful that a second unit has been purchased and installed on another circuit supplying a completely electrified stone quarry where voltage dips were excessive. In this case the reactance is not so great and a somewhat smaller ohmic capacitor is required. Otherwise the unit is identical with the first one in design, construction and size.

Application not universal

While the series capacitor has many advantages to recommend it, its application should not be blindly accepted without careful consideration.

Since the relation of capacitance to capacitive reactance is $X_c = \frac{1}{2\pi fC}$, it is evident that the smaller the ohmic value of capacitor required, the larger and, hence, the more expensive the installation becomes. Thus, for short lines of low inductive reactance the cost is practically prohibitive at present. It is a curious anomaly that in some cases it may be cheaper deliberately to add inductive reactors to the line in order to decrease the size of series capacitor required to produce a desired result.

If large current capacity is required through a high reactance it may be necessary to connect the units in series-parallel, which will quadruple the size of capacitor unit. However, such a condition is not likely to be encountered at distribution voltages.

For loads which are more or less steady, changing only comparatively slowly, where induction type voltage regulators controlled through properly adjusted compensators are used, overcompensating capacitors will be very satisfactory. However, if there is some condition such as a heavy motor-starting current, probably of low power factor, which is a considerable portion of the total line current flowing through the capacitor, the result may be a decided voltage rise.

To illustrate this point, let us assume that we have the same circuit conditions as shown in Fig. 1c, but with an added motor-starting current of 50 amp. at 30 per cent power factor. A comparison of the vector diagrams in Fig. 1c and 1d shows that a voltage rise of approximately 3½ per cent will be produced by the transient low power-factor starting current. When it is considered that induction-type voltage regulators do not act instantaneously it must be realized that a condition will obtain under these circumstances which is fully as undesirable as the voltage dips due to excessive inductive voltage drop. The amount of overcorrection should, therefore, be carefully determined to suit conditions.

The ideal condition would be low ohmic capacitors, small in size and reasonable in cost, which could be installed at intervals of a mile or so, and thus give a comparatively flat voltage regulation characteristic throughout the length of the circuit.

Hollow Concentric Cables Control Conductor Vibration

With rising diameters of transmission cables and growing tower distances, vibrations of these heavy conductors under the influence of wind are difficult to overcome. Recent investigations of the problem have led to the development of a new type of cable, which in itself is vibrationless (*Bulletin Suisse des Electriciens,* May 1934). If two wires are stretched out together in parallel, and the two have greatly different frequencies of vibration, the combination of the two is incapable of sustaining vibrations. A practical design of such a twin cable may consist, for example, of a hollow cable, with a solid wire or a thin solid cable loose in the center of it. If the outer, hollow cable is made of some mechanically strong alloy, the inner cable can be pure aluminum and acts as chief conducting part of the combination. In this case the vibration frequency of the inner cable is lower than that of the surrounding hollow cable.

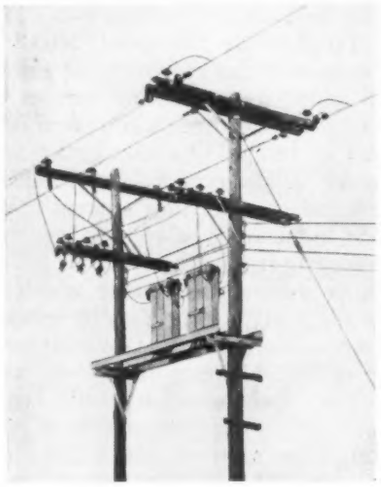
On the other hand, if the calculation indicates that the reverse condition is the more desirable one, a solid galvanized cable is used inside, in which case the outer envelope carries most of the current, while the steel cable acts chiefly as the supporting member. In laying out such twin cables attention must be paid to the proper tension in both members. On all of the supporting masts merely the outer cable is clamped, while on all tension points separate clamping of the outer and the inner cable must be provided.

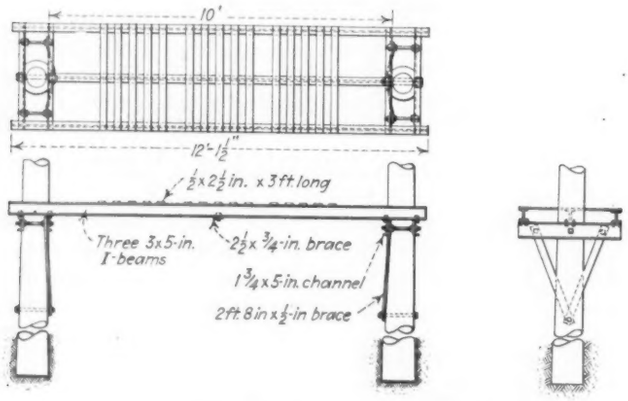
POWER COMPANY ENGINEERING

I-Beams Make Durable Transformer Platform

By F. W. LACHICOTTE
Electrical Engineer, Southern Public Utilities Company, Charlotte, N. C.

For transformer installations above 25 kva. in total capacity an I-beam platform is used on this property. The poles are set with 10 ft. clear between and the platform is made practically 12 ft. long of 3 x 5-in. I-beams supported on two channels at each pole. Cross bracing is provided on the under side at the middle; the floor "boards" provide the requisite bracing on the upper side of the beams. All material is hot-dip galvanized after ends are cut and holes drilled.





Two 25-kva. transformers on all-metal platform and general details of I-beam components

British Water Breakers Reclosed by Powder Explosion

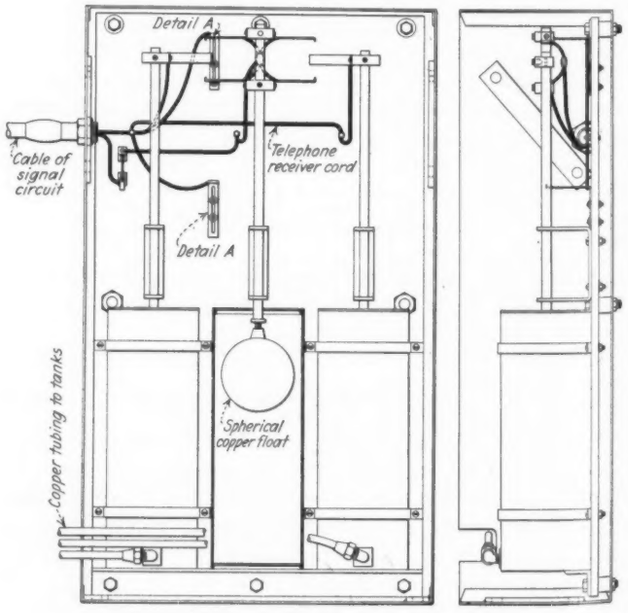
Improved water circuit breakers, the first to be built in Great Britain, have been installed in the St. Albans substation of the North Metropolitan Electric Power Supply Company. The breakers are rated at 250,000 kva. at 22 kv., but have successfully interrupted 274,000 kva. at 19.3 kv. recovery voltage, according to the *Electrical Review* (England). In this new British design an explosion pot containing water is employed. The moving contact rod, when the breaker opens, leaves the fixed contact in an upward direction and the water surrounding it is turned into steam by the arc thus formed. When the moving contact passes out of a throat in the top of the explosion pot the steam expands and the turbulent and blast effect cool and de-ionize the arc space. The upward travel is controlled by accelerating springs and at the end of the stroke the movement is arrested by dashpots. The gases formed by the arc expand into inclined chambers behind the explosion pots.

Circuit breakers are arranged for remote electrical control by means of free-handle solenoid-closing equipment. For emergency reclosing, force and speed sufficient to overcome the steam pressure generated in the expansion chamber are obtained by igniting a charge of gunpowder in a cylinder below the operating plunger. Ignition is obtained by a small element energized from the normal tripping battery. Only one closing mechanism is provided and is conveniently attached to any breaker in the group.

Differential Float Relay Watches Cable Oil

By RICHARD BANZ
Chicago, Ill.

To reduce maintenance costs a type of float relay has been installed in gravity pressure reservoirs for oil-filled cable by the Commonwealth Edison Company, Chicago. By its indications of extraordinary conditions of high or low oil in the line or of significant differences in oil conditions as between the three single-conductor



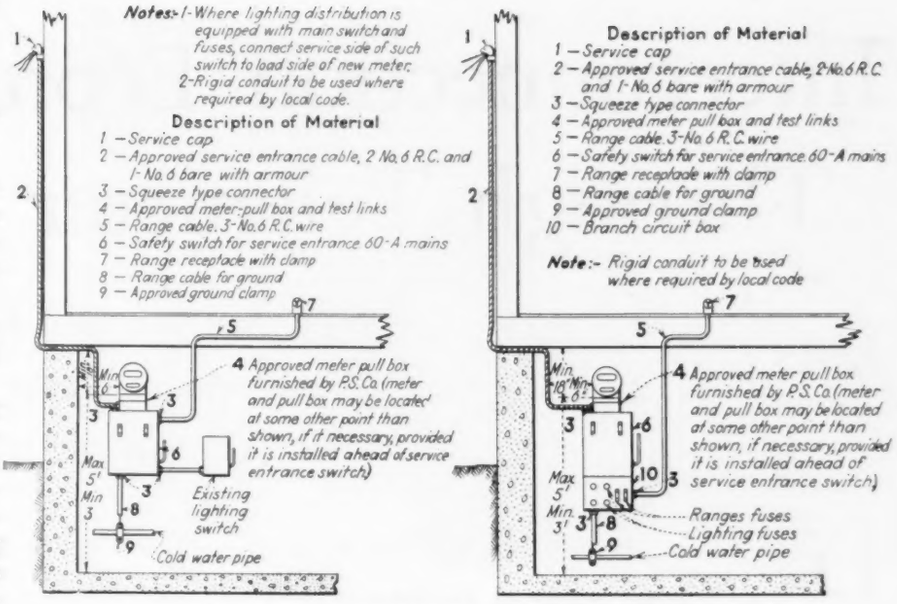
Relay keeps check on cable oil pressures

PRACTICE

cables in the line the relay has made it unnecessary to patrol the line looking for oil leaks as frequently as was considered necessary before this practice was instituted.

The expedient thus increases service reliability, insures better operating conditions and reduces hazards, too.

As shown in the accompanying diagram the relay is an extremely simple device. Floats in the three cable tanks carry vertical rods, on the center one of which is a pair of crosspieces terminating in extended spring brass or bronze strips. Into the jaws thus formed project metal arms attached to the riser rods of the floats in the tanks on each side. Thus if the oil levels in the three tanks remain fairly constant in relation to each other no contacts are made between the arms on the rods. But if the relationship of oil pressures in the three cables is significantly changed, say, by a leak in one, then the particular float drops, a contact is made and a signal results. On the drawing are two details "A." These are contacts that signal the limits of up-and-down movement of the whole assembly and constitute a check upon the oil conditions in all three cables at once.


Notes:- 1-Where lighting distribution is equipped with main switch and fuses, connect service side of such switch to load side of new meter. 2-Rigid conduit to be used where required by local code.
Description of Material
1 — Service cap
2 — Approved service entrance cable, 2 No. 6 R.C. and 1- No. 6 bare with armour
3 — Squeeze type connector
4 — Approved meter-pull box and test links
5 — Range cable, 3-No. 6 R.C. wire
6 — Safety switch for service entrance 60-A mains
7 — Range receptacle with clamp
8 — Range cable for ground
9 — Approved ground clamp
4 Approved meter pull box furnished by P.S. Co. (meter and pull box may be located at some other point than shown, if it necessary, provided it is installed ahead of service entrance switch)
Existing lighting switch
Cold water pipe
Description of Material
1 — Service cap
2 — Approved service entrance cable, 2-No. 6 R.C. and 1- No. 6 bare with armour
3 — Squeeze type connector
4 — Approved meter pull box and test links
5 — Range cable, 3-No. 6 R.C. wire
6 — Safety switch for service entrance 60-A mains
7 — Range receptacle with clamp
8 — Range cable for ground
9 — Approved ground clamp
10 — Branch circuit box
Note:- Rigid conduit to be used where required by local code
4 Approved meter pull box furnished by P.S. Co. (meter and pull box may be located at some other point than shown, if necessary, provided it is installed ahead of service entrance switch)
Ranges fuses
Lighting fuses
Cold water pipe

Range wiring under old and new standards

Range Wiring Standardized for Old and New Installations

The above drawings show the wiring scheme suggested to contractors by the Public Service Company of Northern Illinois for range installations. The meter may be installed either in the basement or other point at location of main line switch or outside of building. The meter-switch-fuse sequence is used with standard meter pull box equipped with meter test terminals in the box (meter pull box furnished by the company).

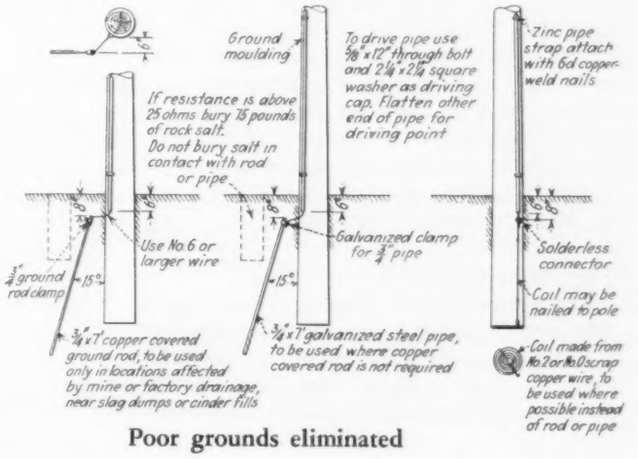
For a range addition installation a non-meter test type switch of sufficient size is required as entrance switch. The existing lighting switch and distribution fuses can be connected two- or three-wire from the service side of the entrance switch, using the existing switch as an additional entrance switch.

On entirely new jobs, when both range and lighting are to be installed, this type of installation may be used except, as is shown in the right-hand sketch, the lighting switch may be eliminated by installing a distribution box only and placing branch fuses for range and lights therein. The main entrance switch, in this case, disconnects both range and lighting circuits or, if circuits are equipped with approved circuit breakers, the main switch may be omitted under conditions as noted in the National Electrical Code.

The service entrance cable to the meter may be armored or of the conventional rigid type conduit. The rest of the wiring may be either non-metallic sheathed cable or conduit as desired. In some localities municipal codes require rigid conduit for certain parts of the wiring. In all cases the local rules govern.

Good Grounds at Poles

In the past a lineman drove a ground rod alongside a pole and let it go at that, without bothering whether he really established a good ground or not. In very recent years a realization of the importance of good grounds brought about both a more careful installation of ground rods and the testing of grounds. Very often when a new pole is set stone and gravel are packed in around it and a ground rod driven alongside the pole is no ground at all, whereas if driven a foot or two away, or a foot or two further down, it may give an excellent ground. The accompanying illustration of West Penn Power Company practice shows the great care that is now being used in ground installations. The top of rod, pipe or connector is 8 in. below ground line. Ground molding extends 6 in. below ground line. Back fill around connector or top of rod must be free of cinders or slag.


Ground moulding
To drive pipe use 5/8" x 12" through bolt and 2 1/4" x 2 1/4" square washer as driving cap. Flatten other end of pipe for driving point
Zinc pipe strap attach with 6d copper weld nails
If resistance is above 25 ohms bury 15 pounds of rock salt. Do not bury salt in contact with rod or pipe
Use No. 6 or larger wire
Galvanized clamp for 3/4" pipe
Solderless connector
3/4" ground rod clamp
15°
15°
Coil may be nailed to pole
3/4" x 7' copper covered ground rod, to be used only in locations affected by mine or factory drainage, near slag dumps or cinder fills
3/4" x 7' galvanized steel pipe, to be used where copper covered rod is not required
Coil made from No. 2 or No. 0 scrap copper wire, to be used where possible instead of rod or pipe

Poor grounds eliminated

Interconnection Economies Through Telemeter Totalizing

New Station and Hydro Connection in Washington Create Operating Problems That Are Solved by Thermal Recorders

By W. J. LANK
Potomac Electric Power Company, Washington, D. C.

DURING the past year two independent power sources were added to the Potomac Electric Power Company system of Washington, D. C., supplementing the existing Benning station. They were the Safe Harbor-Baltimore-Washington 230-kv. transmission line and the 35,000-kw. Buzzard Point steam-generating station. The three independent sources, each remote from the other, are paralleled through load centers to obtain assured continuity of service for these respective load centers. The operation of the three stations, naturally, is not as simple as was experienced with only the single power generating station.

Under the terms of the Baltimore-Washington agreement, the Baltimore company agrees to furnish to the Washington company "firm peak service," or all power and energy above a certain line, known as the "Washington steam line." The "Washington steam line" is established and re-established each year contingent upon the growth of the Washington system indicated peak. This is in addition to other energy interchanged between the two companies in order to obtain maximum over-all economy of generation.

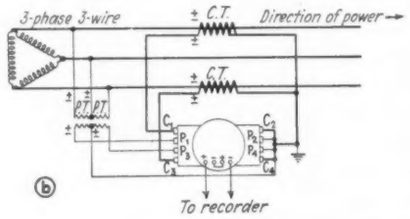
Because of this contract, the maximum indicated Washington system load became a figure of extreme importance. Although the Washington system load is remarkably steady, due to the fact that there are no large industrial customers, it was impossible to obtain this value by adding the wattmeters of the Buzzard Point generator, the nine Benning generators and the incoming or outgoing load on the Takoma interconnection, became of power swings as a result of interconnection between the Baltimore, et al., and Washington generators.

The necessity of obtaining close regulation of the Washington steam plants in order to absorb all of the available hydro energy without overloading the cable circuits during periods of high river flow and the delivery of excess efficient steam power during periods of low river flow is quite apparent.

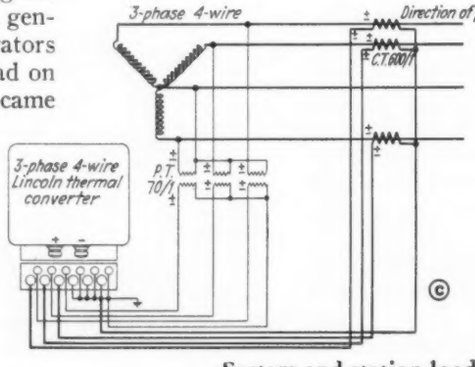
Likewise, the rate of increase and dropping load on steam plants must be regulated and controlled to prevent inefficient boiler room operation. Obviously, the solution of this problem lay in some totalizing system which would record the system load together with its essential components.

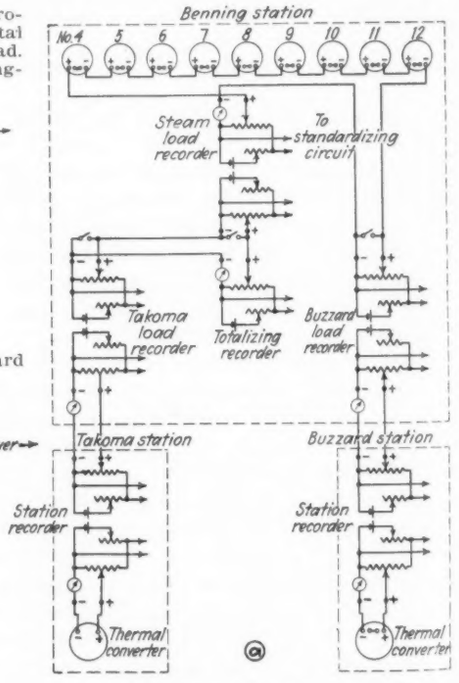
After careful consideration of the merits of various totalizing and remote metering instruments available, it was decided that a system using Lincoln thermal converters and Leeds & Northrup potentiometers was the best obtainable for the purposes outlined above. This system was more practicable for adding and subtracting

(a) At Benning station are four Micromax recorders which show: (1) Total steam load. (2) Buzzard Point steam load. (3) Takoma tie-line load. (4) Washington system load.



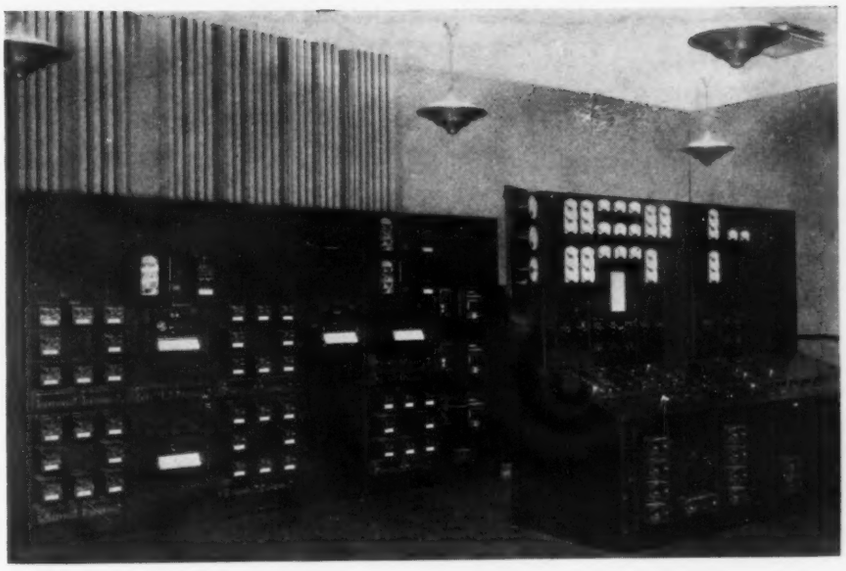
There are also recorders at the Buzzard Point and Takoma stations.





(b) Delta connections for thermal converters in Buzzard Point station and Nos. 4 to 12 in Benning station.
(c) Takoma station has a four-wire Y connection for the converters.

System and station loads totalized at key station



Micromax recorders of the thermal converter totalizer in the load dispatcher's office of Benning Station

the swinging generator and tie-line loads to obtain the system load than dynamic instruments. As well as being low in first costs, the Leeds & Northrup system had demonstrated good sensitivity, reliability, ruggedness and accuracy under actual operating conditions. Operators were already familiar with the use and maintenance of the Leeds & Northrup recorders. This system was placed in operation in September, 1933.

The wiring scheme used in the installation of the totalizing meters is shown in an accompanying illustration. The "total steam load" is arranged to sum up the Benning and Buzzard Point loads. The Washington system load recorder adds to the total steam load the amount of energy in-feed from Takoma or deducts the amount of out-feed from Takoma.

A Lincoln thermal converter is connected to the current and potential transformers of each unit. This current and potential flow through resistances in such a way as to heat one end above the other of a thermocouple. The d.c. potential produced by this thermocouple bears a direct relation to the kilowatt output of the unit. This voltage, or the sum of several of these voltages, is balanced by a standard Leeds & Northrup null type potentiometer and the slide wire on the potentiometer is calibrated directly in kilowatts. Of course, the direct relation between d.c. potential and kilowatts gives a linear scale. The polarity of the d.c. potential depends upon the direction of power flow, so if power changes in direction this converter will automatically subtract, if it added before. These thermal converters may be termed the "quick-response" type, in that they will show 90 per cent of true maximum load change in eight seconds and 100 per cent in thirty seconds.

Interconnection is only justifiable when it makes capital and operating economies possible, but to know whether they are being attained calls for a continuous supply of facts. Telemeter totalizing is often the only way of providing adequate information from scattered points. The thermal recorder installation in Washington gives these essential data with high accuracy.

Readings from Takoma and Buzzard Point recorders are automatically transmitted to Benning over telephone lines, using one circuit from each station. Retransmitters are used for the purpose that a fault on any telephone line will only affect the reading from that particular station. Since only a potential is balanced and no current flows except during periods of change, the resistance of the telephone line does not affect the accuracy, although a large change in resistance would theoretically affect the sensitivity. The voltage used, a maximum of about 1 volt, makes leakage current unimportant.

The manufacturer guaranteed an accuracy (for the system as a whole) of 1½ per cent at any point on the scale within ten seconds after any change. Actually, we have found the instruments catch all changes in Washington system load, and by comparison with integrated readings the error is less than 1 per cent. The only maintenance or adjustment required so far is replacement of dry cells and minor adjustments common to Leeds & Northrup potentiometers used for other purposes.

By the use of these meters the load dispatcher has been able to approach perfect load division between plants and materially improved operation during times of rapidly changing loads. Likewise, the records from these recorders have materially aided in the analysis of intercompany billing, steam operation and system troubles.

Textile Mill Capacitor Permits Load Expansion

Faced with the realization that its plant load was approaching the capacity of its own power plant the Wyandotte Worsted Company, Pittsfield, Mass., purchased a capacitor, which improved the power factor and cut down the load current. The power plant is rated at 500 kw., three phase at 230 volts, with full-load current rating of 1,500 amp. The load was running up to between 400 and 450 kw. at a power factor between 65 and 70 per cent. The peak load current was thus 1,700 amp., which was considerably above the rating of the turbogenerator.

Installation of a 240-kva., 4,000-volt General Electric capacitor reduced the load current peak from 1,700 to 1,300 amp. and raised the power factor from 67 to 88 per cent. As a result of voltage improvement excitation conditions were also improved. Addition of new motors can now be undertaken without overloading the turbogenerator.

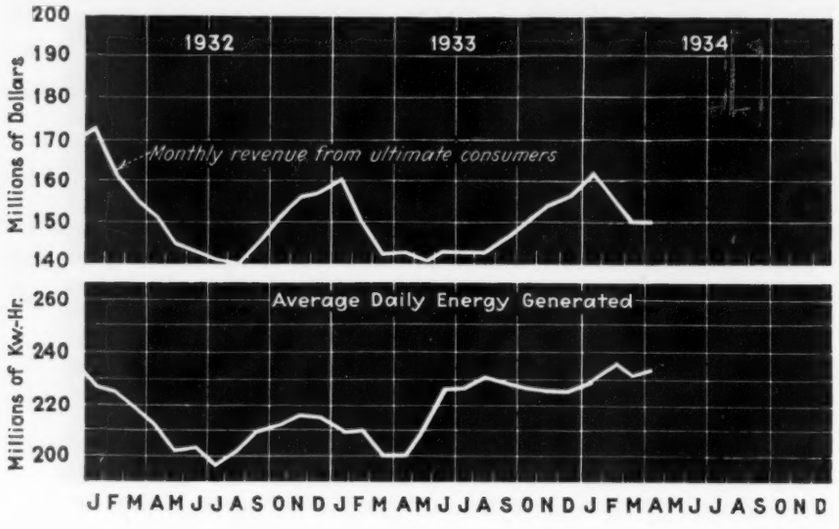
Utility Margin Over 1933 Grows

Revenue in April was $149,851,700, 5.2 per cent over last year's, while output rose 15.2 per cent and large industrial sales increased 28.7 per cent. Earnings in Central states rose 8.1 per cent.

EVIDENCES continue of a gradual upward trend in the operations of electric light and power companies. April brought a total revenue from ultimate consumers fully equal to that of March, whereas a slight decline is usual. The revenue, reported by the Edison Electric Institute as $149,851,700, was 5.2 per cent greater than last year. The rate of gain over 1933 has been gradually expanding from the 1.1 per cent in January, and the very material growth in energy output is at last being reflected in the revenue figures.

Energy production amounted to 6,980,671,800 kw.-hr. (excluding public utilities not regarded as central stations), according to the U. S. Geological Survey, and so was somewhat less than in May, though the daily average for the two months was about the same. There was an increase of 15.2 per cent over last year, against 15.9 in March, 11.5 in February and 10.0 in January. The period of comparison here used preceded the rapid increase that occurred shortly before the middle of 1933.

Production from water power rose to 47 per cent of the total, a proportion that has only occasionally been exceeded. The amount was considerably greater than in March, while production from fuels was nearly 15 per cent less.


1932
1933
1934
Millions of Dollars
Monthly revenue from ultimate consumers
Millions of Kw.-Hr.
Average Daily Energy Generated
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

Industrial use grows

Sale of energy at wholesale has increased 17 per cent since the end of 1933, the amounts, in millions of kw.-hr., during the first four months of the current year being as follows: January, 2,748; February, 2,831; March, 2,971; April, 3,119. The last figure indicates a gain of 28.7 per cent over the like month of 1933. Domestic energy sales were 4.7 per cent greater and retail commercial sales 7.6 per cent greater than a year ago.

Central states lead in recovery

The most conspicuous regional improvement in revenue over last year came in the East North Central division, which accounts for almost one-fourth of the country's total. It amounted to 8.1 per cent. Next was the Pacific, with 7.4 per cent, and New England, with 6.1 per cent. Other regions showed less, with the Middle Atlantic at the foot of the list, with 2.7 per cent.

The revenue figures here given refer to receipts from ultimate consumers only.

Table I—Monthly Revenue from Ultimate Consumers and Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1934	Revenue from Ultimate Consumers		Energy Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
April	149,852	+5.2	6,981	+15.2	3,282	+11.4	3,699	+18.8
March	149,780	+5.1	7,261	+15.9	2,933	+ 1.8	4,328	+27.8
February	154,832	+3.4	6,572	+11.0	2,136	—15.8	4,436	+31.0
January	162,070	+1.1	7,174	+10.0	2,820	— 0.3	4,354	+17.4

Table II—Regional Revenue, Energy Output, in April, 1934

Compared with Corresponding Month of Previous Year

Geographical Region	Revenue from Ult. Consumers		Energy Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
United States	149,852	+5.2	6,981	+15.2	3,282	+11.4	3,699	+18.8
New England	12,990	+6.1	493	+20.7	312	+13.2	181	+36.2
Middle Atlantic	44,469	+2.7	1,744	+17.4	696	+30.4	1,048	+10.1
East No. Central	34,677	+8.1	1,679	+19.5	244	— 6.8	1,435	+25.4
West No. Central	12,495	+4.1	412	+ 5.4	135	— 9.2	277	+14.5
South Atlantic	18,690	+4.2	888	+10.9	607	+ 3.7	281	+30.5
East So. Central			270	+10.7	227	+ 9.6	43	+17.0
West So. Central	7,940	+5.9	325	+ 9.3	31	+27.0	294	+ 7.7
Mountain	4,240	+3.7	223	+21.6	182	+28.1	41	— 1.0
Pacific	14,351	+7.4	947	+13.7	848	+12.0	99	+31.2

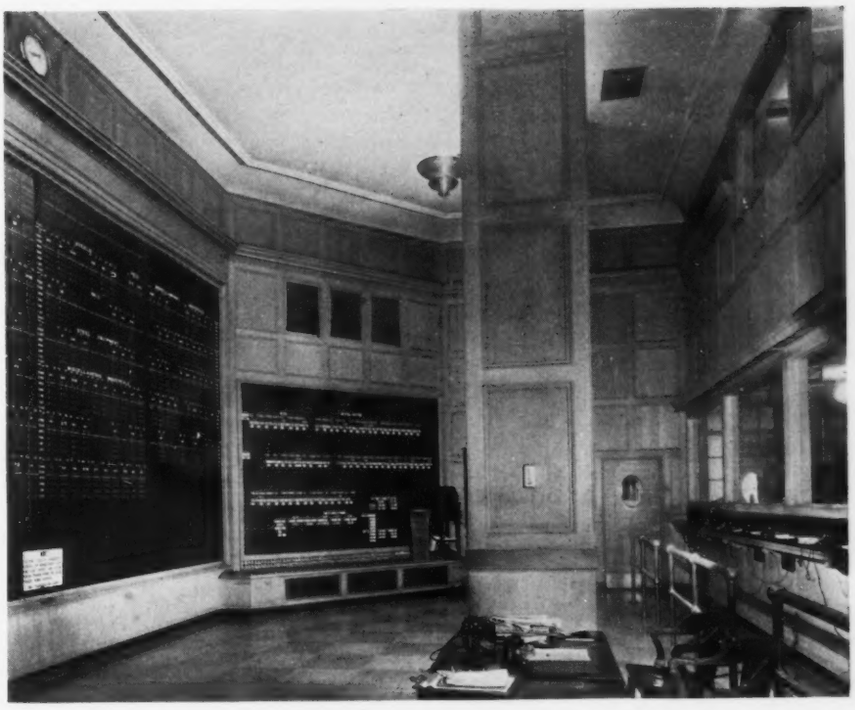
*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central station.

Table III—Allocation of Energy, April, 1934

Compared with Corresponding Month of Previous Year

Class of Service	Millions of Kw.-Hr.	Per Cent Inc.
Total for distribution*	6,978	+15.8
Lost in transmission, etc.	1,136	+ 9.6
Sold to ultimate consumers	5,842	+17.1
Domestic	1,026	+ 4.7
Com'l, small light and power	1,059	+ 7.6
Com'l, large light and power	3,119	+28.7
Municipal street lighting	176	— 1.2
Railways—street and interurban	356	+11.8
Railroads—electrified steam	59	+12.1
Municipal and miscellaneous	47	— 8.9

*Generated, purchased from other sources and imported less energy used in railway and other departments.



Teleregister board room and adjoining rooms of brokerage office are air conditioned. Note the inlet grilles at the floor level and the bank of exhaust grilles under the lighting core. The lighting for this room was described in *Electrical World* of August 15, 1931, page 272.

By R. G. HUTCHINSON
Wetmore-Scott Company, Boston

and D. W. RAMSAY
Industrial Division,
Westinghouse Elec. & Mfg. Co., Boston

Broker Pioneers in Customer-Comfort

Strictly business considerations dictate most air-conditioning installations in semi-public places. Here is a stock broker who in the interests of comfort for customers, new zeal and efficiency of employees and hopes of more business did a little pioneering.

DURING the past summer season one of the largest brokerage houses in Boston air-conditioned its rooms for the comfort of customers and employees. The facilities of its board room are modern in every detail and attract large numbers of customers throughout the trading hours. Extreme discomfort could be corrected only by the installation of air-conditioning equipment. The "wires room," "margins room" and "head margins room" have no outside exposures and are separated from the board room by wood and clear glass partitions. During periods of heavy trading many clerks are employed in these rooms and working hours continue well into the night. The effect of working for long periods in oppressive air was extremely enervating and conducive to low efficiency.

There existed a ventilating and heating system which supplied air to the four rooms under consideration. Three exhaust systems of low capacity removed air from various points in the rooms. Due to the lack of suitable locations for unit type equipment, it was determined to utilize the ventilating system for the distribution of conditioned air. This plan could quite readily be followed for the supply fan and heater casing were located in a penthouse immediately outside of the board room on a flat roof.

A specially designed penthouse was constructed at a point near to the ventilating equipment. In this inclosure were mounted two air-cooled Freon condensing units each of 48,000 B.t.u. per hour rating. Two evaporator coils of like capacity were placed in the existing heater casing between the heating coils and the fan intake. Each compressor and its evaporator coil were connected independently to provide flexibility of operation. All piping and wiring between the two penthouses was carried through conduits with boxes at each turn. In this manner all fittings in the liquid and suction lines are readily available for periodical inspection. Electric control switches are located at a convenient point in the board room.

Determination of the total volume of air to be handled received careful consideration. Different problems of circulation presented themselves in the various rooms, the board room having a height of two stories. Air temperature at the supply grilles and location of those outlets were the determining factors. A total volume of 3,600 cu.ft. per minute was adopted, giving an average 5.8-minute air change. Tests of operation showed a gentle air motion with a sufficiently high entering air temperature to preclude the possibility of cold spots or draughts.

A material smoke problem was encountered. To overcome this condition 2,000 c.f.m. of outside air was introduced at the intake of the heater casing. A duct connection was made from one of the exhaust fans to the same point and 1,600 c.f.m. of air was recirculated from the board room. The outside and recirculated airs were mixed and subsequently passed through filters and over the evaporator coils. The fresh air supply to the rooms

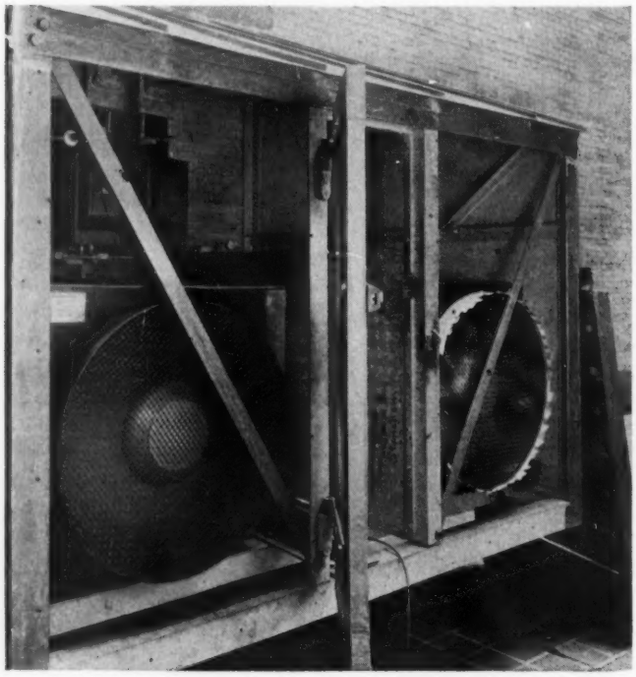
varied from 24 to 43 c.f.m. per person and averaged a ten-minute air change.

It was necessary to provide for the exhaust of 2,000 c.f.m. from the conditioned space. Two exhaust fans remained unused so those fans were employed for the purpose. One fan drew air from the board room, while the other was connected to the three smaller rooms. Their volumes were adjusted to handle somewhat less than 2,000 c.f.m., thereby creating a slight plus pressure in the conditioned space and causing an exfiltration through doors and windows. Exhaust to the atmosphere from the board room was divided between floor and ceiling level grilles. Thus the smoke and excessively warm air which tended to rise and mix with the incoming conditioned air, which was introduced through ceiling outlets, was drawn out through the upper grilles. The lower exhaust outlets produced a desirable diffusion of the entering air and cleared that level of smoke and odors.

Customers attracted by comfortable atmosphere

Operation of the Freon compressors balanced well against the existing loads. Head pressures of 145 to 155 lb. gage were maintained, while suction pressures varied from 30 to 40 lb. The cooling effect of the evaporator coils on the air was, of course, dependent on the relation between the sensible and latent heat loads. Reduction in air temperature ranged from 10 to 19 deg. F. Cooling of the conditioned space registered between 5 and 11 deg. in accordance with the amount of heat and moisture removed. In extremely humid weather a steady flow of condensate from the evaporator coil drip pans was observed. At all times a condition of comfort was maintained as the inherent functioning of the equipment adapted itself to stress either cooling or dehumidifying as weather conditions required.

The value of such an installation to a brokerage house is indisputable. New customers are attracted to a board room in which a condition of comfort prevails regardless of internal crowding and outdoor discomfort. The very fact of the installation of air-conditioning equipment labels the institution as progressive and solicitous of its customers' physical comfort. The monetary return in increased efficiency of employees is difficult to estimate accurately, but it is markedly apparent that work will be performed more accurately and quickly and in a better spirit if the mind and body are relieved of the depressing effect of excessive heat and humidity.



Compressors installed in roof penthouse

Towers have been removed to show intake of air-cooled Freon compressors. Air discharge is from the side and bottom.

Utilities Use 30,575,000 Tons of Coal

During 1933 public utility plants consumed 30,575,000 tons of coal, 9,940,000 bbl. of fuel oil and 102,601,000,000 cu.ft. of gas. Nevertheless, the amount of coal burned was only two-thirds as great as in 1929. Nearly half of the decrease was achieved by greater efficiency in the use of fuel, the remainder was due to a combination of a smaller total output and a record production from water power.

These figures relate to all public utility plants as comprised in the final report by the U. S. Geological Survey on operations in 1933. This embraces central stations, including municipal plants, together with plants operated by electric railways and railroads, the Bureau of Reclamation, public works and that part of the output of manufacturing plants which is sold. Further reduction was made in the average amount of fuel required to produce a kilowatt-hour. This has fallen steadily from 3.2 lb. in 1919 to 1.47 lb. in 1933.

The following table summarizes the changes during the past five years.

Energy Output in Millions of Kw.-Hr.

Year	Total	Water Power	Fuel Power
1929	97,352	34,629	62,723
1930	95,936	33,021	62,915
1931	91,729	30,603	61,126
1932	83,153	34,098	49,055
1933	85,402	34,727	50,647

Consumption of Fuel

Year	Coal, Short Tons	Fuel Oil, Bbl.	Gas, Mill. Cu.ft.
1929	44,937,000	10,124,000	112,707
1930	42,898,000	9,260,000	120,290
1931	38,734,000	8,123,000	139,328
1932	30,290,000	7,967,000	107,875
1933	30,575,000	9,940,000	102,601

Average Fuel Consumption per Kw.-Hr.

Year	Output from Coal, Oil, Gas,* Million Kw.-Hr.	Coal Equivalent of Fuels, Short Tons	Pounds per Kw.-Hr.
1929	62,284	52,574,000	1.69
1930	62,514	50,654,000	1.62
1931	60,768	47,134,000	1.55
1932	48,931	36,600,000	1.50
1933	50,542	37,163,000	1.47

*Output from wood not included.

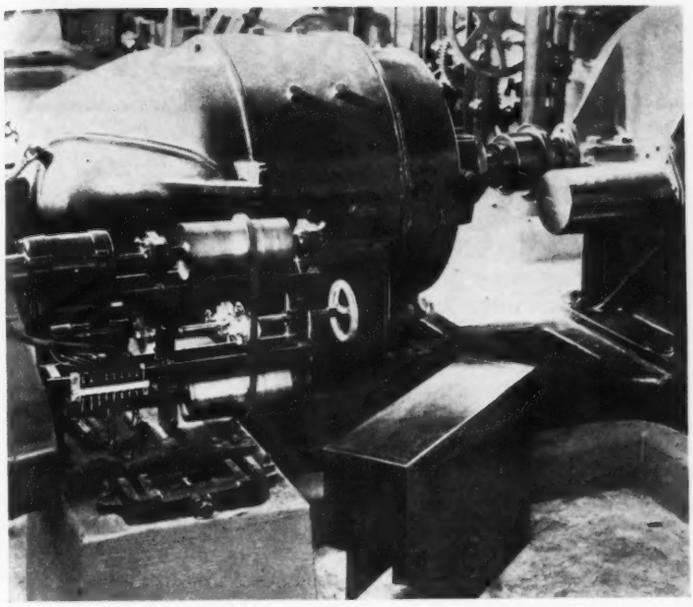


Fig. 1—Selsyn units afford refined speed control. Speed regulator is attached to d.c. motor, which drives each unit of this 90-in. paper machine, in this instance of the first drier section, through a Falk reduction gear

Application of Selsyn Control Adapts Units of Paper-Making Assembly to Production of Varying Grades of Paper

Paper Making—

A Lesson in Co-ordinated Speeds

By H. W. ROGERS

Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

MANUFACTURE of different grades of paper on the same machine requires the ability to modify the speed of any of the various units at will, within certain limits, and continue to maintain the relative speeds of the group within very close limits, as two different grades of paper will not necessarily have the same "draw" or stretch from one end of the machine to the other.

These conditions require a master or reference speed to which all units may be referred, and this consists of a motor-driven Selsyn unit, operated from the same power source as the motors to be controlled.

Each unit of the paper machine is driven by a separate direct-current motor to which is connected a Selsyn transmitter through a pair of small tapered pulleys and a V-belt, as shown in Fig. 1. The rotors of these transmitters and also the master Selsyn unit are all excited from the same single-phase source, while the stators of the transmitter units are connected to the stator of the master Selsyn through differential Selsyn units (Fig. 3).

The differential Selsyn units, which have three-phase windings on both stator and rotor, are each connected to a compression type rheostat, through a cam and lever mechanism, which operates in the field circuit of its corresponding direct-current section motor.

Any number of motors by this system control may be referred definitely to the same reference speed or master, and so long as their speeds are in proper phase relationship with the master nothing happens; the system is at rest. But if there is any angular displacement between a section-driving unit or its Selsyn transmitter and the master this displacement is immediately taken up by the differential Selsyn unit, which rotates, thereby changing the field setting for the direct-current driving motor and again establishing a condition of correct speed with the differential Selsyn unit at rest.

In his system the voltage of master and transmitter are equally balanced and no torque is developed in the differential Selsyn unit, but the slightest angular displacement between the two causes current to flow and develops

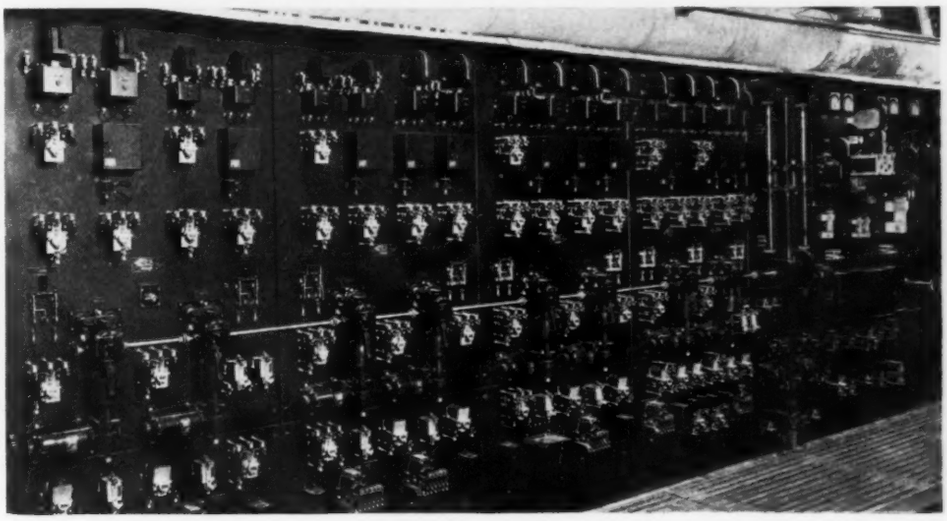


Fig. 2—Speed regulator and cam mechanism on panelboard

Speed regulators are the L-shaped units on each panel for this eight-section paper machine. Cams afford same quick response at all paper machine speeds.

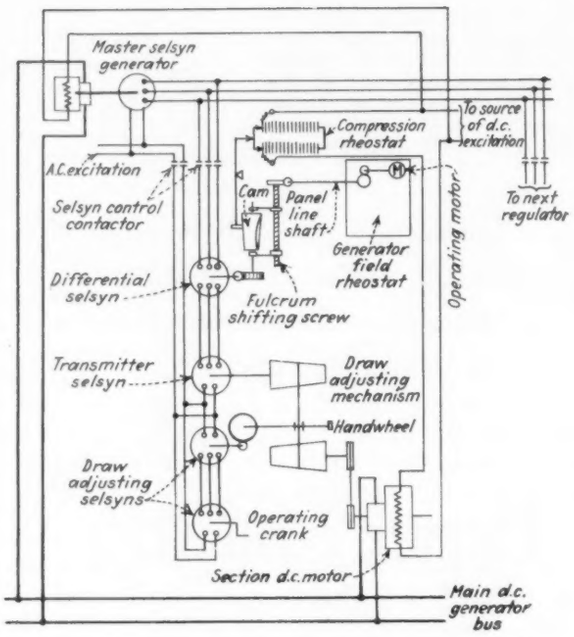


Fig. 3—Draw-adjusting mechanism is automatic or manual

Differential Selsyn unit manipulates compression rheostat and adjusts the field to maintain the speed of the section-driving motor.

torque in the differential Selsyn unit, which immediately rotates in one direction or the other, depending upon the direction of displacement, thereby correcting the tendency to change speed.

The function of the tapered pulleys between the Selsyn transmitters and their respective controlled motors is to permit of changing the speed of the section motor units approximately 10 per cent by shifting the V-belt. Originally this was done by hand at the back of the paper machine, and subsequently it became motor operated, controllable from push buttons on the front of the machine. The motor-operated adjustment of "draw" was not satisfactory since one never knew how much the speed had been altered.

Draw adjustment is automatic

The present method of adjustment involves a pair of Selsyn units connected in the conventional manner, one unit being geared to the belt-shifting mechanism and the other mounted on the front of the paper machine, and since units of this type accurately transmit angular motion, the operator knows positively that if he turns the transmitter Selsyn one revolution the receiving Selsyn will also turn one revolution, and one revolution means a definite amount of speed change.

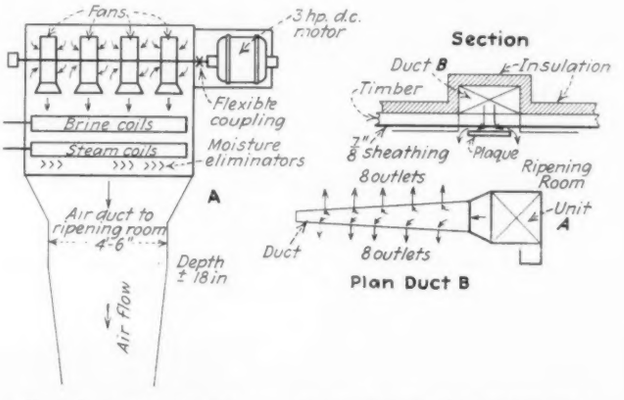
There are other features incorporated in this system of control, such as the variable cam which assures the same quick response of the regulators at low-voltage operation as is obtained at higher voltages, most of these systems being of the adjustable-voltage type. These variable cams are all automatically adjusted by means of a small shaft connected to the main generator rheostat, and since the Selsyn regulators are of the switchboard type a system of this type is compact, efficient, reliable and out of the way, whereas other systems of control require that the regulators be mounted with the driving units in the machine room.

· · · INDUSTRY

Banana Ripening Controlled by Air Conditioning

Mass control of the ripening of bananas to meet the varying demands of the New England market and the fluctuating volume of incoming shipments from the tropics is being effectively accomplished by an extensive air-conditioning installation of the Meloripe Fruit Company, Boston, subsidiary of the United Fruit Company. Green bananas are received from the company's ocean fleet and placed in insulated rooms, each of which is equipped with a combination fan, brine and steam coil unit built by the York Ice Machinery Corporation and designed with the aid of a Powers regulator system to maintain temperatures close to stated points within an operating range of from 58 to 75 deg. F. The lower temperature is required to hold the fruit back from ripening and the higher one cannot safely be exceeded. The temperature control and humidity furnished in these rooms enables the fruit company to supply the market with bananas ripened to meet the expected demand and has done away with the old practice of delivering green bunches to distributors and retailers for ripening on their premises in a more or less haphazard fashion, involving at times considerable loss through too rapid or too slow maturing.

To provide the necessary facilities at the centralized



Sketch (not to scale) of larger air-conditioning unit

which serves banana ripening room through inclosed ceiling duct and plaque-shielded outlets to save space rented on a volume basis.

point for proper control of ripening, 28 rooms are available, storing from 800 to 1,800 bunches each. The insulation of the rooms is equivalent to 4 in. of cork and the temperature is held automatically within about 0.5 deg. F. of the point set for the different service requirements.

The air-conditioning units are of two sizes, the smaller ones, serving the lower and smaller rooms (about 52x16 x7 ft.), being rated at 8.5 tons cooling capacity. Each consists of an assembly mounted between the ceiling of the room and the floor of the larger rooms above. A

PRACTICES IN BRIEF · · ·

1.5-hp., 220-volt Westinghouse variable-speed, direct-current motor drives two American Blower double intake squirrel-cage fans on a common shaft with flexible coupling between motor and fans, the air delivery capacity being 4,000 cu.ft. per minute. This outfit has an inclosing chamber providing short air run to the (25 deg. F.) brine and (18 lb.) steam coils and moisture eliminators are provided in each assembly. The larger units contain four fans each, direct driven by a 3-hp. motor of the same make and general design, and deliver 8,000 cu.ft. per minute. Maximum motor speed is 1,150 r.p.m. and normal speed usually about 800 r.p.m. The motors operate continuously when ripening or holding is in progress. A system of closed air circulation is provided, with one thermostat per room. A humidifying system is operated under manual control during the daytime. The flexibility of the air-conditioning service has given a highly satisfactory control of fruit ripening in approximately a year's use of the installation at this important receiving and distributing station.

Splitting Crane Drum Solves Special Hoist Problem

By GEORGE E. WHITTAKER
Resident Electrical Engineer,
Chase Brass & Copper Company, Cleveland

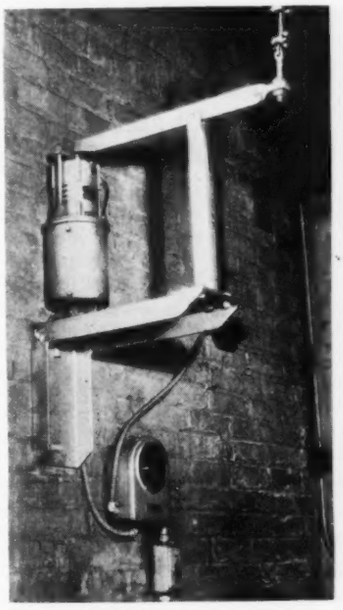
Among the different operations in the making of brass and copper seamless tubing are several that require the tubes to be dipped into a succession of tubs for pickling and washing. It is necessary that the tubes be thoroughly drained when removed from each liquid and before undergoing the next dipping operation.

Regular brass mill cranes for handling these tubes are usually equipped with two hoists operated from a single drum with one motor and one control. These hoists are located about 7 ft. apart, each with a main hook to which is attached a spreader, fabricated of structural steel, and equipped with a number of secondary hooks to handle effectively tubes of varying lengths.

To facilitate the drainage of these tubes at the Cleveland mill of the Chase Brass & Copper Company the drums of the cranes were cut in half and each half equipped with its own hoist, motor and control. With the two control levers placed side by side in the crane cab the two hoists can be operated singly or in unison, and by this means either end of a load of tubes readily raised higher than the other by any amount desired or considered necessary to speed the draining.

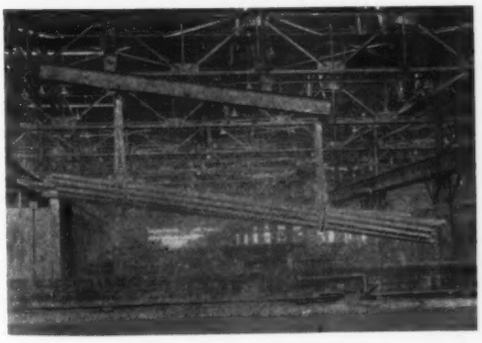
Working Hours Whistled by Power Link to Clock

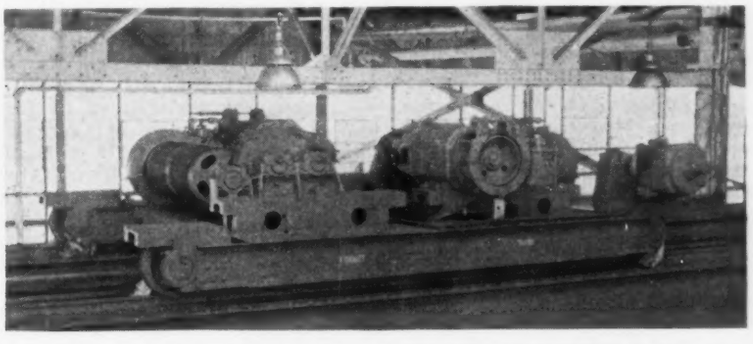
By J. W. NASH
Plant Engineer Bendix Aviation Corporation, South Bend, Ind.



The "Thrustor" blows the whistle

Working hours in the plant of the Bendix Aviation Corporation at South Bend, Ind., are not signaled at start and finish by any human agency. There is no power plant employee whose duty it is to lean on the whistle cord at stated times, morning, noon and night. The official whistle blower that does the clock watching for all employees is a clock itself. The equipment, as shown in the accompanying illustration, includes a synchronous clock driving a program tape on which is recorded the whistle schedule for a week. Contacts made by the movement of the tape close the circuit of the "Thrustor," which then obliges with corresponding pull or pulls upon the whistle cord, terminating at the upper right in the illustration, and at the other end of the lever from the "Thrustor."





Left—Tilting bundle of tubes from pickling tub for draining. Right—Two large motors handle the hoists, the small motor moves the crane trolley laterally

LETTERS TO THE EDITOR

Germany's 380-Kv. Line

To the Editor of the ELECTRICAL WORLD:

With reference to the article "Germany's 380-Kv. Line," on page 623 of the April 28, 1934, issue of the ELECTRICAL WORLD, we would like to state that although the neutral of the 220-kv. line of the R.W.E. is not solidly grounded, it is grounded through Petersen coils. Perhaps this additional information will be of interest.

H. ZIELINSKI,
Resident Engineer.
Allgemeine Elektricitäts-Gesellschaft,
Schenectady, N. Y.

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Industry Helps Census to Better Statistics

To the Editor of the ELECTRICAL WORLD:

I have just finished reading the article "When Use Is Measured by Comparable Unit Values," which appears in the May 26 issue of the ELECTRICAL WORLD. I consider this article most interesting and timely, and believe it will do much toward clarifying the question of averages and rates.

In our final report of the Census of Electric Light and Power Companies for 1932 we are not presenting comparisons with 1927 in the statistics on the disposal of energy. As you know, prior to the 1927 report, the schedule called for practically no information regarding disposal of energy by class of service. While the 1927 report carried disposal of energy data similar to those for 1932, the bureau was unable to secure a complete breakdown of service and was obliged to carry a large "undistributed by class of service" item. Therefore, in making a comparison between the 1927 and 1932 figures, the reader would have to take into account this large "undistributed" item, in addition to the fact that the two years are scarcely comparable since 1927 was approaching the peak year, while 1932 was during the depression period. Both of these factors would affect the average rate for the various classes of service.

Z. R. PETTET,
Chief Statistician.
Bureau of the Census,
Washington, D. C.

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Those Lead-Pencil Motors

To the Editor of the ELECTRICAL WORLD:

In your May 19 issue in the article "Oil-Well-Bottom Pumps Bring Lead-Pencil Motors" you give the diameter of the 97-hp. motor as less than 8 in. For your information the 97-hp. motors have considerably less than 8-in. diameter, being exactly 5⅜ in. Inside of 7¼ in., which is also less than 8 in. referred to in your article, we are building 250-hp. motors.

A. ARUTUNOFF.
Reda Pump Company,
Bartlesville, Okla.

BOOK REVIEWS

Seeing and Human Welfare

By Matthew Luckiesh. Published by the Williams & Wilkins Company, Mount Royal and Guilford Avenues, Baltimore, Md. 190 pages, illustrated. Price, $2.50.

Evolution teaches us that biological adaptation to environment is a matter of generations untold. Modern civilization imposes upon our eyes close-up tasks; work of primitive peoples involved grosser objects at greater distances. Small wonder that excessive convergence and scanty lighting have made us a race of adults one-half dependent on aids to vision. The toll in fatigue, discomfort and expense is stupendous. Measuring it in terms of curtailed production gets only a fraction of the penalty paid. Seeing is far more than a matter of relying upon the retina to get a message to the brain. Seeing includes making the object so advantageously visible that the ocular task is minimized. Dr. Luckiesh shows how human welfare lags because so little has been done to conserve the seeing-energy and the correlated reserves of energy in the human being viewed as a seeing machine in this world of machines.

The book is not technical. It is a straightforward plea for better lighting so that vision may be conserved and seeing become a balanced contribution to human welfare and economy.

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The Engineering Foundation Arch Dam Investigation

Published by the United Engineering Trustees, Inc., for the Engineering Foundation, 29 West 39th Street, New York, N. Y. Vol. II. 542 pages, illustrated.

This volume reports the results of tests on two models of arch dams conducted by the Bureau of Reclamation at the University of Colorado. There are also data on tests of auxiliary concrete specimens. The objective was to check the safety of reclamation dams built and building, especially the 727-ft. Boulder Dam. Not all the complicated stress and deformation problems have been solved, but designs have already been rendered more economical and the trial load method of analysis has been confirmed. There are more than 175 charts and stress diagrams covering Stevenson Creek (1/12th size) and Gibson (1/68th size) test dams. Data for the Boulder Dam model will appear in a subsequent volume.

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Short Wave Wireless Communication

By A. W. Ladner and C. R. Stoner. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y. 379 pages, illustrated. Price, $3.75.

First published two years ago by these two Marconi engineers, this work has now been revised to include the recent rapid developments. These are the better knowledge of the ionosphere and its bearing on skip distance, improvements in short wave modulation, perfection of radiating "feeder" technique and Lecher wires, the progress in aerial arrays and considerable new material on ultra short wave directive systems. Marconi's "Elettra" surveys on the ocean and the advances resulting from 6.8 and 4.9 meter television and sound broadcasts from the top of Empire State Building have been incorporated. An appendix on feeder loss and efficiency has also been added.

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America's Capacity to Produce

By Edwin G. Nourse and Associates. Published by the Brookings Institution, 26 Jackson Place, Washington, D. C. 597 pages; illustrated. Price, $3.50.

That the margin of unutilized plant capacity in agriculture, mining, manufacturing and electric utilities did not expand during the 1900-1930 period is the conclusion reached by these investigators. Transportation did grow much faster in capacity than in utilization, but construction and merchandising apparently did not change materially in ratio. For an over-all figure it is concluded that there was 19 per cent of added production of which our whole industrial plant was technically capable under the conditions prevailing in 1929. Utilizing that available capacity would have created enough more earning capacity to have brought the 16.4 million families whose incomes were less than $2,000 all up to that level or have increased by 42 per cent all family incomes below $3,500.

In an exhaustive chapter devoted exclusively to electric utilities it is concluded that "perhaps 11 per cent out of the observed 27.5 per cent margin of unused capacity in 1929 might be set down as simple provision for growth." The real excess of capacity at that time is called small when reserve for breakdown, maintenance and hydro variations are intelligently discounted. In fact, the guess is hazarded that central station capacity in 1929 was somewhat below the full-capacity requirements of the mines and factories dependent on central station power.

"America's Capacity to Produce" is a pungent statistical and analytical contribution toward answering the dilemma—must we have regimentation of capital, labor and currency to check the vagaries of thrift as they are exemplified in too much reinvestment of savings in excess productive facilities? The rest of the planned series will deal with "America's Capacity to Consume," "The Formation of Capital" and "Income and Economic Progress."

NEWS OF THE WEEK

Knoxville Asks Bids for City Network

Work on city's distribution system slated to begin August 1, as T.V.A.-Tennessee Public Service negotiations reach impasse. Lilienthal warns of powerful forces opposing valley program.

Following the announcement by Director David E. Lilienthal of the Tennessee Valley Authority that representatives of the T.V.A. and the Tennessee Public Service Company had failed to reach an agreement, the city of Knoxville immediately advertised for bids on the construction of a new municipal power distribution system and on transformers and sub-station equipment for the entire system. These bids will be opened July 17 and the contract awarded. Construction work is slated to begin August 1.

Mr. Lilienthal had offered C. E. Groesbeck, chairman of the board of the Electric Bond & Share Company, $6,550,000 for the public service company's holdings and had given him until June 20 to accept the offer. Mr. Groesbeck turned it down.

New offer by Alabama Power

After further negotiations a revised offer for the sale of the Alabama Power Company's electric distribution facilities in northern Alabama was received by the authority last week. Commenting on the new offer as it affects Tuscumbia, Sheffield and Florence, Mr. Lilenthal said: "The price fixed is one with which the authority is in substantial, though not entire, agreement, provided the final figure is likewise agreeable to the municipalities involved, inasmuch as the plans contemplate resale of these properties to the communities. The authority will confer with them at an early date to learn whether such a program is acceptable to them, or whether they prefer to press their applications for loans from the P.W.A. with which to construct new plants. The authority believes that the purchase at a fair price will be in the public interest, as it will eliminate the delay involved in contemplating new distribution systems and will avoid substantial losses to investors arising out of competition."

Coal association indorses suit

Reaffirming the opposition of the bituminous coal industry to further multiplication of T.V.A. hydro-electric power projects, the National Coal Association announced its endorsement and support of the suit recently instituted in the federal courts of Alabama by 23 coal companies challenging the legality of the T.V.A. power program and seeking injunction to restrain its execution (ELECTRICAL WORLD, June 23, page 922). At a meeting held last week, attended by representatives of all of the 30 coal-producing fields of the country, the association's board of directors adopted resolutions sharply assailing the T.V.A. program as "a life and death matter" to the bituminous coal industry, commending the bringing of the injunction suit and pledging the aid of the association in the prosecution of the litigation.

Lilienthal sees sinister influences

In an address made at Jackson last week before civic leaders from several West Tennessee cities, Mr. Lilienthal said: "I am not an alarmist, but I want to warn you that powerful forces are at work to deprive the South of the greatest opportunity that ever came to any people. . . . The first great test is in your hands here in the Tennessee Valley. Under the cover of various disguises, power forces are at work to destroy the long-time objectives of the Tennessee Valley Authority. In order to fill their own pockets these powerful groups are ready at any cost to destroy the Tennessee Valley Authority's program."

F. R. McNinch Renamed Power Commission Head

Apparently confirming the intention of the administration to round out its power and utility program, Frank R. McNinch was renamed a member of the Federal Power Commission by President Roosevelt last week. Mr. McNinch has been a member of the commission since his appointment in 1930 by President Hoover and has been chairman for the past year. Under his chairmanship the commission has undertaken a threefold study based on Mr. Roosevelt's power program. A nation-wide survey of power sites, a national survey of electric rates and a study of the costs of energy transmission from hydro-electric plants are the three projects that will be carried on under Mr. McNinch's leadership.

New Deal for Electrical Engineers Discussed at Hot Springs Meeting

American Institute of Electrical Engineers celebrates its 50th anniversary. Realignment of education to meet changing professional demands sought. Stillwell stresses value of power interconnection as national safeguard

MEETING to celebrate the notable achievements that have marked its 50 years of existence, members of the American Institute of Electrical Engineers at Hot Springs, Va., this week found many profound problems facing the profession in the immediate future. Three hundred members, including nine of the 22 living past-presidents, met to discuss the realignment of engineering education with the changing demands of professional practice and the call upon the engineer for responsible service to society.

W. C. Wickenden, president of Case School of Applied Science, Cleveland, in a spirited address showed how the professional engineer occupies an anomalous status between the wide open vocational and tightly professional groups. Society has meanwhile come to think it should exact guarantees of competency in the rendition of technical services for the common good, Mr. Wickenden held. No group, in his opinion, has maintained higher professional ethics than the engineering profession. Mr. Wickenden made a vigorous plea for establishment of a unified profession of engineering transcending the scope and contributions of the individual professions. Union and fusion, in his opinion, is far more the need now than mere federation or co-operation.

L. B. Stillwell receives Lamme medal

Award of the institute's Lamme medal to Lewis B. Stillwell brought into focus one of the recipient's major achievements that marked a milestone in early electrical progress. Acceptance by the Niagara Falls Power Company of his 1890 recommendation to adopt alternating current for the generation at the initial Niagara installation was cited as having averted a decision that would undoubtedly have confirmed direct current for many more years of dominance, and consequently might have occasioned a postponement of our present nation-wide electrical systems. In responding, Mr. Stillwell recalled the state of the transformer and generator art of that era and the happy selection of the 60 and 25 cycles which have become the ruling frequencies. He called attention to the often recognized value of power system interconnection in time of national emergencies and feared that blind resentment against some of the unfortunate mistakes of the industry might lead to an unnecessary degree of governmental activity in the electrical field. This would weaken much of the security now potentially provided through wide availability of bulk power to support industries in sudden preparation for war, Mr. Stillwell said.

C. F. Hirshfeld of Detroit reported on the proposals of the Engineers' Council for Professional Development as to the definition of engineering and the unification of membership qualifications among the various engineering societies. A minimum definition of an engineer is proposed which would demand graduation from an approved four-year (or longer) engineering course in an approved school or college, to be followed by four years or more of active practice and the passing of a written and oral examination covering technical, economic and cultural subjects. Eight years or more of acceptable practice would be an alternative to the college degree clause

as a prerequisite for membership and governmental certification. Along with this it is proposed that all engineering societies have only student member, junior member and member grades.

A.I.E.E. finances improve

Contradicting the fears of a year ago, the financial condition of the A.I.E.E. was reported to be materially improved. As a consequence there was manifest a reasonable disposition to restore some activities that have been curtailed, especially those which would react to the direct benefit of the local sections and the scattered membership. At the conference of section and district delegates a resolution was advanced to the board asking authorization for sections and districts to form technical committees parallel and contributory to the committees of the national organization.

A review of the discussions at the technical sessions on the final three days will be presented in next week's issue of ELECTRICAL WORLD.

J. Allen Johnson, chief electrical engineer Buffalo, Niagara & Eastern Power Corporation, was elected president of the institute for year beginning August 1. The other officers elected were: Vice-presidents, W. H. Timbie, Cambridge, Mass.; R. H. Tapscott, New York; G. G. Post, Milwaukee, Wis; T. J. Meyer, Oklahoma City, Okla., and F. O. McMillan, Corvallis, Ore. New directors elected were F. Malcolm Farmer, New York; N. E. Funk, Philadelphia, and H. B. Gear, Chicago. National Treasurer W. I. Slichter was re-elected. These officers, together with the following hold-over officers, will constitute the board of directors for the coming year: J. B. Whitehead (the institute's retiring president), H. P. Charlesworth, R. B. Bonney, F. M. Craft, A. H. Hull, R. W. Sorensen, A. M. Wilson, L. W. Chubb, B. D. Hull, P. B. Juhnke, G. A. Kositzky, Everett S. Lee, A. H. Lovell, L. W. W. Morrow, A. C. Stevens, H. R. Woodrow.

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Commission to Investigate Additional Utilities

Investigation of the affairs of several additional electric light and power companies is now under consideration by the Federal Trade Commission, it was announced this week. The investigations will be undertaken under the recently passed congressional resolution extending until January, 1936, the time in which it shall complete its public utility investigation.

The only investigation now definitely determined on will be into the affairs of the Texas & Louisiana Power Company. Several additional companies will be the subject of early hearings, reports on their affairs having been completed by the commission's field investigators.

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Philadelphia Company Marks Its 50th Anniversary

More than 5,000 employees of the Philadelphia Company, Pittsburgh, participated in the ceremonies marking the fiftieth anniversary of the company last week. The event was celebrated by a dramatization of highlights of the company's development, which was broadcast in a special radio program.

The first president of the company was Winthrop Smith, who served only two months. He was followed by George Westinghouse, electrical pioneer, who served from 1884 to 1897. Following came James H. Reed, father of the present Senator David A. Reed, who remained in office until 1919. He was succeeded by A. W. Thompson, who completed his term of office in 1926. A. W. Robertson, now chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, was president until 1929, being succeeded by John J. O'Brien, president of Standard Gas & Electric Company. Frank R. Phillips, the present incumbent, took office in 1931.

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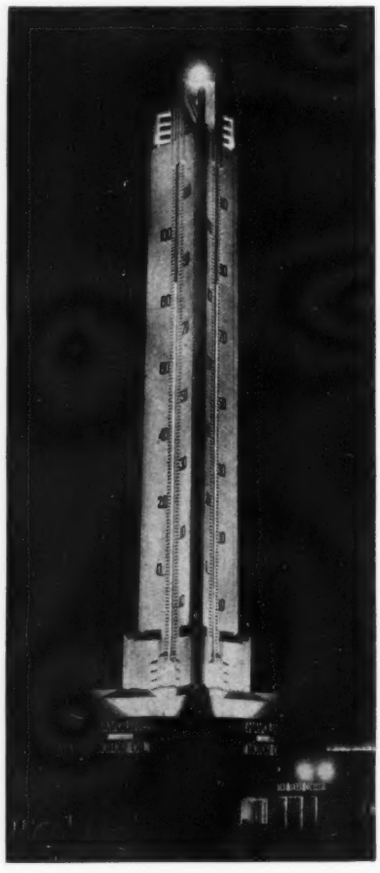
Spectacular Lighting by Mercury-Vapor Lamps



Illustrating a new use to which the versatile high-pressure mercury-vapor lamp may be put, six 220-volt General Electric Vapor Lamp Company units aid Havoline in drawing attention to its giant Century of Progress thermometer. Two units are installed on each of the three sides of the thermometer top, each pair burning base up in front of a curved metal reflector. Despite the competition offered on all sides by multi-hued lighting displays, the distinctive color of mercury-vapor lamps gives prominence to the beacon.

Appalachian Company Defies Commission

Refusing to seek a license under water power act, Appalachian Electric Power Company announces its intention to proceed with New River hydro construction.

Serving notice on the Federal Power Commission that it intends to proceed with the construction of its hydro-electric development on the New River, Virginia, the Appalachian Electric Power Company has announced its plans to proceed with the work in defiance of the commission's order compelling it to seek a license. This is the second test of the Federal Power Commission's authority under the federal water power act, the other case involving the Electro Metallurgical Company and the New-Kanawha Power Company, against whose hydro-electric project on the New River in West Virginia the Department of Justice filed a bill in equity this month (ELECTRICAL WORLD, June 23, page 923).

Tied up in litigation for more than nine years, the Appalachian case has retarded a development estimated to cost $11,000,000. The power commission has insisted that the company acquire a major license, which would impose federal regulation over its financial structure, and give the government or state the right to recapture the property in 50 years. The company has disputed the right of the commission to require this license, holding that the New River is non-navigable, and that therefore federal regulation does not apply. The company has expressed itself as willing to give a guarantee against interference with navigation in tributaries, but it will go no further.

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Milwaukee Strike On; Service Is Uninterrupted

Although several hundred strikers picketed ten of the eleven plants of the Milwaukee Electric Company, the long-heralded strike of the company's American Federation of Labor union workers failed to bring about the threatened disruption of electric light, power and transportation services. Estimates place the number of employees on strike at between 700 and 1,400.

The difficulties between the company and its union employees have been brewing for some months. They resulted from the discharge by the company of thirteen street car operators. The unions demand reinstatement of all discharged men and an election by crafts to obtain representatives for collective bargaining. The company offered to agree to an election with bus, street car and electrical system employees voting as a unit, but refused to accept a vote by divisions. The Milwaukee utility's Blue Eagle was recently ordered surrendered by NRA Administrator Johnson, after regional and national Labor Board rulings held the company's action in discharging the men was a discrimination against union labor in contravention of Section 7a of the national recovery act.

Engineering Educators Confer on Problems

Record attendance at Cornell University meeting of Society for the Promotion of Engineering Education. Electronics and communication discussions feature meeting.

Marked by a record-breaking attendance of 1,100, the 42d annual meeting of the Society for the Promotion of Engineering Education was held last week at Cornell University, Ithaca, N. Y. During the first few days of the meeting an innovation was the holding of nineteen conferences, each on a separate part of the curricula. Round-table discussions, professional papers and the technique of teaching occupied the attention of the delegates. Notable among the discussions was the conference on electronics and communication — subjects that have undergone rapid engineering changes recently.

Auditing agency approved

The council met and approved the Engineers Council for Professional Development as an accrediting agency for engineering schools. This action and the paper on the E.C.P.D. by C. F. Hirshfeld created considerable discussion of the new trend toward raising professional standards and for placing the accrediting of engineering schools upon a semi-legal basis with the state licensing boards.

At the opening general session President W. E. Wickenden stressed the value of intimate contact between the student and younger faculty members and the creative leaders in the faculties and in industry. He pointed out the enviable record of engineering college graduates and indicated modifications that will make the product even better in the future. Provost A. R. Mann welcomed the delegates and stressed the point that it was education and not training that should be accented in this rapidly changing period. Harvey N. Davis of Stevens Institute stressed the same point. The engineering school is not training engineers unless it accomplishes a broader function and prepares men for life. In his opinion science and engineering have a true cultural niche and are basic to modern education. Dean R. E. Doherty of Yale stressed the necessity for defining the function of engineering education and the classification of the courses in terms of the functions and the aptitudes of the student. Gordon M. Fair told of the optional method recently introduced at Harvard to stimulate the student and to permit a greater scope in his selection of subject matter.

The second day's sessions were marked by a symposium on marketing the engineering graduate. Other papers dealt with detail policies and subjects. In general, there was a greater realization of the necessity to afford more specialization, as well as more breadth in courses. The fifth year idea was brought up several times as an answer to many of the problems. Co-operation with industry in research and engineering also was a subject for discussion. C. F. Scott made a report for the board of investigation and co-ordination, which did such notable work from 1923 to 1929 in studying engineering education.

E. R. Maurer gets Lamme Medal

The Lamme Medal, given annually by the society, was presented to Edward R. Maurer, professor of mechanics at the University of Wisconsin, at the closing session of the convention. Officers elected for the next year are: Prof. C. C. Williams of Iowa State University, president; H. P. Hammond of Brooklyn Polytechnic Institute and Dean G. C. Shaad of the University of Kansas, vice-presidents; W. O. Wiley of New York, treasurer, and Prof. F. L. Bishop of the University of Pittsburgh, secretary.

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N. Y. Electrical Association Aids in Appliance Ordinance

The Electrical Association of New York is co-operating with the city's Commissioner of Water Supply, Gas and Electricity in working out the terms of the recently proposed ordinance for licensing of merchants selling electrical appliances (ELECTRICAL WORLD, May 12, page 702). The association has recommended that the approval of the American Standards Association be accepted as the basis for the New York City standards, tests under these standards to be made by any nationally recognized laboratory. It is believed that the designation of the American Standards Association by New York City would hasten the development of nationally recognized standards in electrical appliances. This would help to avoid the confusion that would come from the establishment of independent testing laboratories by various cities, each setting up different requirements.

The ordinance, as presently drafted, provides for license fees of $15 for the first year and $10 a year thereafter for all stores selling electrical appliances. The measure is one of many being introduced for the purpose of raising additional revenue for the city.

COMING MEETINGS

National Electrical Credit Association—Annual meeting, Chicago, July 19-20. Frederick A. Lind, 1010 Marquette Bldg., Chicago.

Producers and Distributors of Electrical Energy—Fifth International Congress, Zurich and Lausanne, Switzerland, August 29-Sept. 7. Secretary, Union des Centrales Suisses d'Electricite, 301 Seefeldstrassé, Zurich.

Electrochemical Society — Sixty-sixth convention, Hotel Pennsylvania, New York City, September 27-29. Colin G. Fink, Columbia University, New York.

Illuminating Engineering Society—Annual convention, Baltimore, Md., October 1-4. D. W. Atwater, secretary, 29 West 39th Street, New York.

International Association of Electrical Inspectors — Southern section annual meeting, New Orleans, La., October 1-4. Joseph Whitner, P.O. Box 1743, Atlanta, Ga.

. . . THIS WEEK IN WASHINGTON

Piney and Saluda River projects to have cost hearings before Federal Power Commission July 9. F. R. McNinch, reappointed to Power Commission, is re-elected chairman.

FINAL arrangements have been made for the important hearings before the Federal Power Commission in the determination of costs in connection with the Piney development of the Clarion River Power Company and the Saluda River project of the Lexington Water Power Company. Each of these hearings is scheduled to begin July 9, but the Clarion River Company's case will be taken up first. The Lexington company's hearing will be adjourned from day to day until the Clarion River case will have been completed. One hearing already has been held in an effort to dispose of the questioned items involved in the construction of the Piney plant. Although questions have been raised on items totaling more than $10,000,000 in connection with the construction of the Lexington company's project, the items really in controversy aggregate an amount between $1,000,000 and $2,000,000.

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Frank R. McNinch has been given a recess appointment for another term as a member of the Federal Power Commission. While the Senators from North Carolina, Mr. McNinch's state, are expected to vote against his confirmation, the understanding is that they will not go to the length of holding that he is personally objectionable to them. Under those conditions his confirmation is expected. Mr. McNinch has been re-elected chairman of the commission. Clyde L. Seavey, the new member of the Federal Power Commission, expects to take up his new duties August 15. That much time will be required for him to wind up his work with the California Railroad Commission.

PAUL WOOTON,
Washington Correspondent.

N.E.M.A. Clarifies NRA Pricing Policy

To eliminate confusion among electrical manufacturers resulting from recent announcements of NRA's new policy regarding pricing provisions in codes, the National Electrical Manufacturers Association has issued an announcement to members of the electrical manufacturing industry intended to clarify the situation. The statement asserts that the NRA policy anouncement does not affect codes already signed except as they may be amended from time to time. It further states that the published price activities under the electrical manufacturing industry code continue to be effective, and that all requirements of the present code remain effective until revision of the code has been approved.

Free Energy Offer Results Announced

California utilities report more than 50% of eligible customers took advantage of offer in first month. Domestic cooking, heating loads show greatest increase.

More than half of the eligible customers of the San Joaquin Light & Power Corporation and Midland Counties Public Service Corporation took advantage of the free electricity offer of those two utilities during the first 30 days, the period between the April and May meter readings. As announced last February (ELECTRICAL WORLD, February 10, page 234), the offer permitted all domestic lighting, cooking and heating customers and commercial lighting customers to use all the electricity desired during April and May for the same amount as paid in March.

Greatest free users, as revealed by the first month's figures, were the domestic cooking and heating customers. About 75 per cent of this classification on the lines of both utilities took advantage of the offer and used 165.5 additional kilowatt-hours in the case of San Joaquin and 228.5 kw.-hr. in the case of the Midland company. Data on the various classes of customers and their energy use for the first month are shown in the table below.

Agricultural load expands

Agricultural power consumers of the two companies were offered a rate of one-half the regular rate for all energy used in excess of the amount used during the same months of April and May in 1933. In the case of the San Joaquin company 4,493 customers, or 31 per cent of the 14,627 agricultural customers, used 4,574,701 kw.-hr. of additional energy at this reduced rate. In the case of the Midland company 416 agricultural power customers, or 59 per cent of the total, used 1,273,906 kw.-hr. in taking advantage of the offer during the first 30 days. Complete data covering the entire period of the offer will not be available until after the June meter readings.

In promoting the offer the two utilities, together with the Valley Electrical Supply Company, the merchandising subsidiary, used 26,700 column inches of newspaper advertising, to which co-operating dealers, contractors, distributors and manufacturers added 33,700 inches of tie-in advertising.

In the opinion of the managements of the companies the results thus far indicate that the additional costs incurred will be more than returned from the additional revenue that has been obtained from the sale of appliances. From a service standpoint no operating difficulties were experienced and no system bottle-necks due to lack of distribution capacity developed.

Upon the conclusion of the free electricity period domestic lighting customers become eligible for a promotional rate whereby they continue to receive free kilowatt-hours provided their consumption during any one month exceeds their consumption for the same month in the previous year. If, during ten months out of a period of twelve consecutive months, a consumer qualifies for such free kilowatt-hours, he automatically is placed permanently upon the promotional rate, which consists of the present combination lighting, cooking and heating rate. A consumer may also qualify for this rate by installing 2 kw. or more in cooking, heating or water-heating appliances other than socket devices. Both utilities are now engaged upon an extensive program of promotion of this offer.

Results of Free Electricity Offer for April-May Meter Reading Period

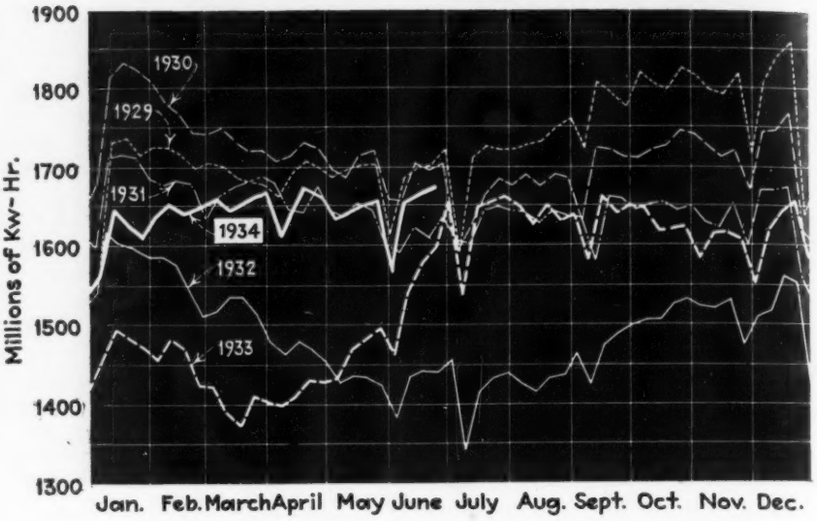
San Joaquin Light & Power Corporation

Account No.	Class of Business	Total Consumers	Consumers Using Free Electricity No.	Consumers Using Free Electricity Per Cent	Gross Sales, Kw.-Hr.	Free Kw.-Hr.	Average Free Electricity per Consumer Who Used Free Kw.-Hr.
301	Signals, blinkers, etc.	162	21	13.0	313,977	1,780	84.7
302	Public building lighting	650	185	28.0	195,498	9,829	53.1
306	Commercial lighting	8,631	4,042	47.0	2,081,460	414,425	102.5
308	Domestic lighting	51,439	25,583	49.0	2,666,927	603,760	23.6
309	Domestic heating and cooking	7,930	5,990	75.0	2,557,457	991,476	165.5
	Sub-total	68,812	35,821	52.0	7,815,319	2,021,270	56.4

Midland Counties Public Service Corporation

301	Signals, blinkers, etc.	51	3	5.0	72,167	273	91.0
302	Public building lighting	146	40	27.0	25,834	1,824	45.6
306	Commercial lighting	2,383	1,147	48.0	484,522	109,307	95.3
308	Domestic lighting	8,433	4,083	48.0	424,629	94,342	23.1
309	Domestic cooking and heating	1,999	1,505	75.0	717,404	344,040	228.5
	Sub-total	13,012	6,778	52.0	1,724,556	549,786	81.1
	Grand total	81,824	42,599	52.0	9,539,875	2,571,056	60.3

Output at Late 1931 Peak



Breaking through the highest figure for any week, even in midwinter, of the past two and a half years, electrical energy production during the week ended June 23 rose to 1,674,566,000 kw.-hr., according to the Edison Electric Institute. This was 4.8 per cent more than in the same week of last year, and only 1.6 per cent under the 1929 record for the nearest corresponding period. With one exception in December of 1931, when it was very slightly exceeded, it was the biggest week's production since April, 1931. It surpassed by a small margin the current year's previous record made in the week of April 21.

In New England an extraordinarily rapid rise last year accounts for the recession of 4.9 per cent from 1933 and in the Central industrial area a similar though less spectacular rise at that time explains the smaller gain than in other recent weeks. Percentages in the Middle Atlantic and Pacific regions increased moderately.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
June 23...1,675	June 24...1,598	June 25...1,441
June 16...1,665	June 17...1,578	June 18...1,442
June 9...1,655	June 10...1,542	June 11...1,435
June 2...1,576	June 3...1,461	June 4...1,381
May 26...1,655	May 27...1,494	May 28...1,425

Per Cent Change from Previous Year

Region	Week ended June 23	Week ended June 16	Week ended June 9
New England	— 4.9	— 2.1	— 2.2
Middle Atlantic	+ 6.6	+ 5.7	+ 7.0
Central Industrial	+ 5.7	+ 7.3	+10.3
West Central	+ 7.4	+11.7	+12.6
Southern States	+ 4.3	+ 5.2	+ 4.5
Rocky Mountain	— 0.3	— 0.7	+12.5
Pacific Coast	+ 9.8	+ 7.4	+ 8.6
United States	+ 4.8	+ 5.5	+ 7.3

Edmundson Report Reflects Increased British Sales

Emphasizing the improvement in British energy sales, the report of Edmundson's Electricity Company, one of the larger British electrical producers, shows net profit for the year ended March 31 of £402,839, against £342,795 for the previous year. The corporation's consolidated balance sheet shows total assets of £17,668,906, cash and securities of £1,145,967, depreciation reserve of £2,919,672 and net free reserves of £1,014,086.

As to Rates . . .

New York Public Service Commission has approved a general reduction in electric rates for six utility companies serving a large sector of northern New York. The companies are: Malone Light & Power, St. Lawrence County Utilities Norwood Electric Light & Power, Northern New York Utilities, Antwerp Light & Power, Raquette River Power. All are part of the Niagara Hudson System. The cut will result in a yearly saving of $248,000 to consumers. The rates were part of an agreement effected by the commission with Niagara Hudson last fall, when proceedings were begun to force a reduction.

Union Gas & Electric Company has been granted a new five-year contract by the city of Middletown, Ohio, providing for new rate charges for electricity. Figured on the basis of a six-room house, using an average of 45 kw.-hr. a month, the new cost means a reduction to $2.78 from $3 under the old rate. The reduction is estimated at 7.9 per cent.

Telluride Power Company has filed a petition in the Tenth Circuit Court of Appeals, Salt Lake City, Utah, requesting that the state Public Utilities Commission be restrained from enforcing its order for a blanket 10 per cent reduction in the company's power rates. The principal question in the case is whether the commission was justified by the economic emergency in reducing rates for electric power below the limit of fair return and below the point held by courts in normal times to be confiscatory. John D. Rice, Deputy Attorney-General, appearing for the state, admitted that returns of the company in 1933 amounted to only 2.47 per cent, but declared that while all other businesses are operating at a loss the state is not obligated to maintain the earnings of an essential utility. W. Q. Van Cott, counsel for the company, told the court that on the new rates prescribed by the commission the company would default on its bonds. His principal argument was that enforcement of the commission's order would be confiscation of the company's property.

Mississippi Light & Power Company's offer to put into effect a 12 per cent rate reduction at Greenville, Miss., was rejected by the City Council when Mayor Milton C. Smith polled the deciding vote. Municipal operation was proposed at the meeting. Mayor Smith said he was not in favor of the utility, because it would not be of any material help for those who consumed from $1.50 to $6.50 worth of power per month. A vote was taken giving Mayor Smith authority to obtain valuation of the distribution system.

Kansas Public Service Commission has announced that Kansas utilities corporations have reduced their rates sufficiently to bring about a saving of more than one million dollars a year to the domestic consumers of the state. All of these reductions came as the result of negotiations between the commission and the utilities companies. None resulted from complaints which brought about hearings or investigations. The largest amount of savings to the consumers was in gas rates. Next came the electric light and power rates. Telephone rate reductions played only a small part in the aggregate savings. Homer Hoch, chairman of the commission, who issued the announcement, said that the savings are based on the consumption figures for the last year and the amount of the saving will be increased as consumption is increased.

Indiana Public Service Commission has approved new electric rates with reductions of about 6 per cent for Gosport, Norristown, Geneva and Batesville. Gosport is served by the Northern Indiana Public Service Company, Geneva and Norristown by the Southeastern Indiana Power Company and Batesville by the Batesville Light & Power Company.

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Kansas Verdict Upholds Charge Against Plant

A recent verdict given in the Jackson County (Kansas) District Court, if upheld in superior courts, may have far-reaching effects on the communities which are attempting to use municipal utility plants to raise revenues to take the place of taxes. Maintaining that the municipal plant was overcharging its customers to raise money to run the city, Holton Creamery Company brought suit. In effect it was charged that the city was overcharging the large users of electricity to raise money to meet the tax obligations of other property owners. The jury in the case gave the creamery company a judgment for $2,000.

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Bond Issue Authorized for Middlesboro

At a recent meeting of the city governing board an ordinance authorizing a bond issue for a new municipal electric light plant was adopted. The ordinance declared an emergency existed in the present lack of lights on the city streets. The utility company recently cut off all street lights, claiming the city was delinquent in paying for energy (ELECTRICAL WORLD, June 23, page 926).

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Electric Range Changeover Gains in Amherst

Rapid progress continues in the substitution of electric ranges for gas-heated units in the kitchens of Amherst, Mass., where the local gas company is going out of business on account of high costs of manufacture and purchase. Vice-President H. E. Duren of the Western Massachusetts Electric Company, which serves this town under affiliation with the grouped utilities of the Western Massachusetts Companies, stated last week that 575 agreements have been closed for electric ranges among the 826 home customers hitherto using gas for cooking. Eighty per cent of these agreements provide for the voluntary payment by the customer of some amount for improved facilities over and above the free replacement terms offered by the company in its equivalent service exchange plan outlined in the ELECTRICAL WORLD, June 2, 1934, page 812. Only three gas customers have ben lost to "bottled gas" cooking to date.

The Western company has established a new rate doing away with the area charge in residential service. The first 40 kw.-hr. per month is to be billed at 8.5 cents each, the next 160 at 3 cents each and the excess over 200 at 2.5 cents each.

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Laurel, Miss., to Vote on Plant

Resolutions passed unanimously by the mayor and city commissioners of Laurel, Miss., call for sealed bids to be received on July 24 for construction of a municipal light and power plant. Also voted upon at the session was a formal notice to the officials of the Mississippi Power Company that the City Commission would meet on July 23 to "fix reasonable and just" electric rates.

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To Vote on Plant

City commission of Bay City, Mich., has ordered a public vote on a proposal to increase the municipal light department sinking fund to $500,000 with the intention of building a generating plant. The increase would be slightly under $100,000. Energy is now being purchased from the Consumers Power Company. The vote will not be cast until the fall.

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Valuation Order Appealed

Northwestern Electric Company has appealed in Circuit Court from the recent order of the public utilities commissioner of Oregon fixing the valuation of the company's Oregon properties. The company asked the court to review the testimony presented in the valuation proceedings before the commissioner last year and to set aside the commissioner's order substituting therefor such fair valuation as the court may determine. No rate adjustment accompanied the commissioner's valuation order so that rates are not an issue in this present case.

The commissioner placed the value of the company's properties used for furnishing electric service to Portland and Multnomah County at $9,412,827 for rate-making purposes. The company contends that the value for this portion of its total property should be $12,800,000, which is about $1,000,000 below the cost of reproduction new, less depreciation. Another point of difference lies in the commissioner's ruling out as no longer used and useful some $500,000 or more of the company's installed generating equipment.

FINANCIAL · · · BUSINESS

So. California Edison Cuts Dividend to 6%

Because of an increase in taxes and added fuel costs, Southern California Edison Company directors have voted a reduction from an 8 per cent to a 6 per cent annual basis on the common capital stock of the company. A quarterly dividend of 37½ cents a share on the stock was declared, payable on August 15 to stockholders of record of July 30. "The increase in taxes, amounting to approximately $900,000 for 1934, as compared with the first depression years of 1930 and 1931, together with a further increase in fuel bill, owing to this year's subnormal water supply, has offset to a large degree the effect of the increased business, as well as further operating economies which have been put into effect," said President Bauer.

Previous dividends had been on a $2 annual basis since 1926, which was a continuation of the annual $8 rate, prevailing when the company's original par $100 shares were split four for one.

Former Bankers Seek to Restrain Long Island Lighting Bond Issue

Suit filed in New York court asserts $6,845,500 refunding bonds would prevent payment of preferred and common dividends. Company plans to fight suit.

SEEKING to restrain the Long Island Lighting Company from entering into certain contracts or executing certain indentures in connection with a proposed sale of $6,845,500 of first refunding mortgage 5 per cent bonds at a price of 93 to New York insurance companies and savings banks, two investment bankers have filed a bill of complaint in the New York Supreme Court. The action is significant in that one of the complainants, Chester Dale, is a partner in W. C. Langley & Company, which has handled nearly $32,000,000 of the company's securities in the past 17 years.

One of the contracts embodied in the proposed issue to which the bill of complaint objects would impose restrictions preventing payment of any dividends until $4,535,200 of first mortgage bonds due on March 1, 1936, have been retired or refunded. In addition, preferred dividends may not be paid unless earned, and common dividends are prohibited until common stock and surplus have reached $20,000,000. The present figure is $6,278,630. Arguing that these and other restrictions in the proposed contracts are excessive, the bill of complaint reads:

"There is no necessity, in order to effect a sale of said bonds, for the company to enter into any covenants or agreements whatsoever restricting its operations or the exercise of their discretion by future boards of directors, or interfering with the management of the company or curtailing the rights of stockholders to receive future dividends." The complaint further argues that the directors or officers of the company are not empowered to execute the supplemental indenture in the proposed contracts without the consent of the holders of two-thirds of the preferred and common stock of the company. Officials of the Long Island Lighting Company indicated this week that they would contest this last contention.

Seeks to refund floating debt

The purpose of the new issue is to liquidate $6,000,000 of demand loans held by several large New York banks. In addition, there are $6,359,104 of other unsecured demand notes outstanding. The prospective purchasers of the bonds have made it a requirement that the holders of these notes accept an issue of convertible debentures junior to the new bonds.

A common-stock holders' committee issued a statement in connection with the suit in which it asserts the terms of the proposed issue would have the effect of "severely restricting dividends on preferred and common stock, will injure the investment of the preferred- and common-stock holders and seriously hamper the company in financing its present and future requirements and its ability to serve its consumers. In addition, the committee understands that certain limitations are being placed upon the issuance of mortgage bonds of the company which, if made effective, will make it more necessary than ever for the company to finance through junior securities, although, as above stated, such securities are adversely affected by the agreement itself."

Phillips writes to stockholders

Following the publication of the stockholders' committee statement, the company addressed a letter to stockholders, signed by E. L. Phillips, president, which relates the company's efforts to refund its floating indebtedness. The letter tells how the company, having received Public Service Commission approval to issue series B refunding bonds to the extent of $6,845,500, filed a certificate of registration with the Federal Trade Commission. W. C. Langley, head of William C. Langley & Company, as a director, the letter asserts, forced withdrawal of the registration. The company then received a trade commission ruling that the issue could be sold to private investors as an exempt transaction. The statement says that the company has been endeavoring to sell the new bonds for more than a year and that this proposal of the insurance companies and the savings banks is the only definite offer which it has had for them.

The company statement asserts that Mr. Langley has opposed the proposed sale from the beginning of the negotiations and that all the other directors approved the proposed contracts. The majority of the directors believe that it is not good policy to disburse cash in dividends on the common stock while there is so large a floating indebtedness, the letter states, and that the proposed conditions on common dividend payments are not only reasonable but are for the best interest of the company and all of its stockholders, and that the equity of common-stock holders is not impaired, but is conserved by suspension of dividends.

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Middle West Concurs in Creditors' Proposal

In response to a court petition of creditors that Middle West Utilities Company be reorganized under the provisions of Section 77-B of the bankruptcy act, the company concurred this week in the proposal and expressed the belief that not only will such procedure be for the best interest of its creditors but also that it will best serve the interests of preferred- and common-stock holders. The answer, which was signed by D. C. Green, president, was filed by attorneys for the preferred- and common-stock holders' committees.

HERE'S SUMMER

June draws to a close with energy production, registering its third successive weekly increase, now at a point only 1.6 per cent from its all-time high for the week. Together with another rise in carloadings and sustained strength in bituminous coal production, these figures would seem to indicate that industrial activity and movement of manufactured goods might carry over the summer without a general business slump. More than confirming the worst fears of those who forecast a drop in steel output, however, a 20 per cent decline in production in that industry has occurred. This news, apparently well discounted in market circles, was greeted by an appreciable advance in general stock prices. Bonds continued to show strength, and commodity prices, exhibiting mixed trends, generally maintained their high levels.

Birmingham Electric Pays on Preferred Dividends

As a result of the withdrawal last week of litigation against the company by preferred-stock holders, the Birmingham Electric Company began disbursement of $3.50 a share on its $7 preferred stock and $3 a share to holders of its $6 preferred, both of record of May 1. The dividends are the first since October, 1933, when payments of 87½ cents and 75 cents, respectively, were made. The dividend was made possible by an agreement entered into between the Birmingham company and its parent, National Power & Light Company, under which the parent agreed to provide Birmingham Electric with $430,000, the approximate amount of preferred dividends in arrears (ELECTRICAL WORLD, April 28, page 636). Legal difficulties involving the Birmingham company arose from the payment of a special dividend of $3,200,000 on the common stock in 1929, which was held by National Power & Light.

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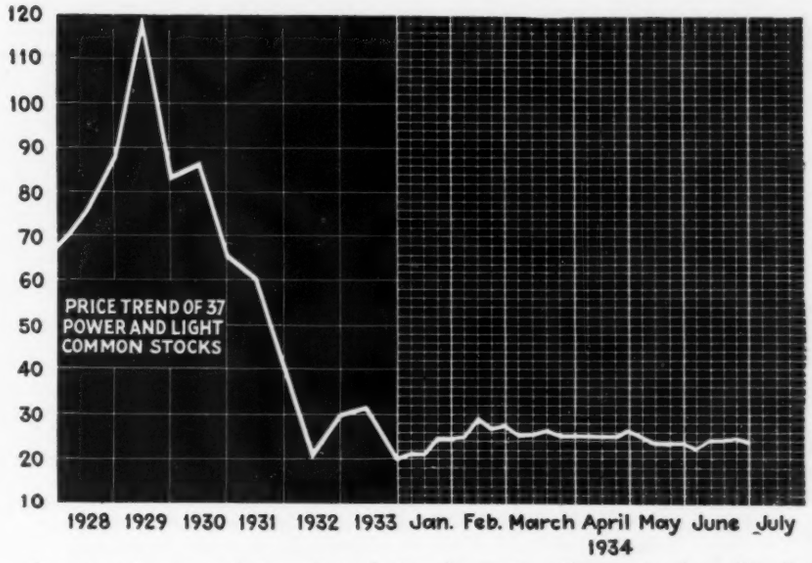
British Energy Output Shows Sharp Rise in May

An increase of 11.9 per cent in the total output of authorized undertakers during May over the same month last year was achieved in Great Britain, the British Electricity Commission reports. Output for the month was 1,125,000,000 kw.-hr., compared with 1,005,000,000 for the same month in 1933. During the first five months of 1934 the total amount of electricity generated by authorized undertakers was 6,581,000,000 kw.-hr., compared with the revised figure of 5,610,000,000 kw.-hr. for the corresponding period of 1933, representing an increase of 17.3 per cent.

Utility Stocks Decline Slightly



Security prices moved irregularly during the week. Changes in the utility list were sufficient to carry the *Electrical World* index down to 24.2, as compared with 24.9 last week.

Northeastern P. S. Plan Approved by Court

Holding that the proposed reorganization plan for Northeastern Public Service Company was fair, timely and equitable, the Delaware Chancery Court

Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1934	1933	Per Cent Increase	Operating Ratio 1934	Operating Ratio 1933
Alabama Power (Year ended April 30)					
Gross earnings	$15,679,020	$15,149,637	3.5	50	48
Net earnings	7,858,673	7,800,924	0.7		
Net balance	814,293	820,559	— 0.8		
Carolina Power & Light (Year ended April 30)					
Gross earnings	9,506,460	8,659,350	9.8	61	62
Net earnings	3,717,213	3,266,300	13.8		
Net balance*	97,066	517,024	.....		
Detroit Edison (Year ended May 31)					
Gross earnings	43,931,594	41,730,359	5.3	68†	71†
Net earnings	14,108,021	11,967,950	17.9		
Net balance	7,438,863	5,399,943	27.8		
Florida Power & Light (Year ended May 31)					
Gross earnings	9,980,570	9,883,935	0.9	60	53
Net earnings	3,978,103	4,657,077	— 14.6		
Net balance*	1,035,743	281,952	.....		
Georgia Power (Year ended April 30)					
Gross earnings	22,349,163	21,784,120	2.6	51	48
Net earnings	10,921,577	11,237,053	— 2.8		
Net balance	1,856,274	2,098,120	— 11.5		
Memphis Power & Light (Year ended April 30)					
Gross earnings	6,178,150	6,423,456	— 3.8	72	70
Net earnings	1,715,628	1,886,142	— 9.0		
Net balance	482,711	643,922	— 25.0		
Montana Power (Year ended May 31)					
Gross earnings	9,026,392	8,163,246	11.0	57	53
Net earnings	3,827,709	3,843,198	— 0.4		
Net balance	400,919	618,867	— 35.0		
Nebraska Power (Year ended May 31)					
Gross earnings	6,181,567	6,017,070	2.7	57	55
Net earnings	2,624,852	2,679,994	— 2.1		
Net balance	1,283,191	1,443,941	— 11.0		
New Orleans Public Service (Year ended April 30)					
Gross earnings	14,959,278	15,179,493	— 1.0	77	75
Net earnings	3,439,857	3,844,265	— 10.5		
Net balance	2,309*	358,710	—100.0		
Ohio Edison (Year ended April 30)					
Gross earnings	15,340,763	14,639,129	4.8	51	49
Net earnings	7,569,995	7,508,592	8.2		
Net balance	1,815,885	1,811,645	0.2		
Tennessee Electric Power (Year ended April 30)					
Gross earnings	11,838,193	11,237,354	5.3	61	58
Net earnings	4,664,880	4,737,326	— 1.5		
Net balance	468,912	524,350	— 10.6		
Texas Power & Light (Year ended May 31)					
Gross earnings	9,254,874	9,009,904	3.0	51	51
Net earnings	4,501,767	4,452,953	1.0		
Net balance	1,152,223	1,136,610	1.0		
Utah Power & Light (Year ended April 30)					
Gross earnings	9,515,292	9,996,943	— 5.0	62	56
Net earnings	3,614,711	4,371,108	— 17.3		
Net balance*	1,110,479	384,193	.....		
Washington Water Power (Year ended May 31)					
Gross earnings	7,466,058	7,394,361	1.0	61	57
Net earnings	2,889,915	3,197,335	— 9.6		
Net balance	1,184,564	1,504,701	— 21.0		

Holding Companies

	1934	1933	Per Cent Increase	Operating Ratio 1934	Operating Ratio 1933
American Power & Light and subsidiaries (Year ended March 31)					
Gross earnings	$73,270,052	$73,942,856	— 0.9	58	54
Net balance	3,687,500	6,999,343	— 47.4		
Electric Power & Light and subsidiaries (Year ended March 31)					
Gross earnings	69,044,303	72,033,989	— 4.1	65	60
Net balance	1,502,264*	2,997,801	—150.0		
National Power & Light and subsidiaries (Year ended March 31)					
Gross earnings	69,400,854	69,511,545	— 0.2	61	60
Net balance	6,677,635	7,770,465	— 14.1		

* Deficit. † Operating and non-operating expenses included.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings—Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net balance—Balance available from income for common stock dividends.

has ordered it approved. The way is thus made clear for the reorganization committee to proceed with consummation of the plan.

The committee was authorized to extend to not earlier than July 20 the time in which general lien and collateral trust 5½s and unsecured claims may be deposited. An extension of time to the same date was provided for making cash payments under the plan. The order also directed sale at Wilmington on July 24 of all assets pledged under first lien indenture and assets not subject to first and general lien indentures.

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San Carlos Insulator Contract Awarded

Three carloads of "Pyrex" suspension and pin-type insulators and suspension hardware have been ordered from the Corning Glass Works under a contract with the United States Indian Irrigation Service of the Department of the Interior. The insulators will be used on the San Carlos project in Coolidge, Ariz.

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G. E., Westinghouse Cut Incandescent Lamp Prices

Reductions in the list prices of 150, 200, 300 and 500-watt incandescent lamps were announced simultaneously this week by Westinghouse Lamp Company and the General Electric Company. Westinghouse prices are cut from 10 to 30 cents, while General Electric reductions average 13 per cent. In announcing the reductions both companies report increased sales in these categories of lamps as a factor in the price slash.

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Arrow-Hart & Hegeman Declares Dividends

Regular quarterly dividends were declared last week by Arrow-Hart & Hegeman Electric Company. Ten cents a share will be paid on the common and $1.62½ on the preferred stocks, both payable July 2 to stock of record June 25.

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Ranges Net $1,100,000

Based on the reports of eleven companies, the National Electrical Manufacturers Association announces total billed sales of electric ranges during May of 16,394 units valued at $1,124,736.

New York Metal Prices

	June 19, 1934 Cents per Pound	June 26, 1934 Cents per Pound
Copper, electrolytic	9.00*	9.00*
Lead, Am. S. & R. price	4.00	4.00
Antimony	7.85	7.80
Nickel ingot	35.00	35.00
Zinc, spot	4.55	4.55
Tin Straits	50.25	51.125
Aluminum, 99 per cent.	23.30	23.30

*Blue Eagle

SALES OPPORTUNITIES IN NEW CONSTRUCTION

Spot coverage of the week. Projects approved and proposed, bids requested, equipment wanted, funds available. Prospects for the electrical manufacturer.

Baton Rouge, La.—Solvay Process Company, New York, N. Y., plans installation of transformers and accessories, motors and controls, electric pumping machinery, elevating and conveying equipment, air compressors and other equipment in new multi-unit alkali plant at Baton Rouge. A $2,500,000 project.

Independence, Mo.—Plans early call for bids for one 3,000-kw. turbo-generator unit and auxiliary equipment for city-owned electric light and power plant. Fund of $124,000 being arranged.

Knoxville, Tenn.—Tennessee Valley Authority asks bids until July 9 for three 3,333-kva., single-phase, self-cooled power transformers, to step down from 115,000 volts to 13,200 volts, for service for municipal distribution system.

Highlands, N. C.—Nantahala Power & Light Company, Bryson City, plans new transmission line from power plant at Highlands to Cashiers Valley district.

San Diego, Calif.—Consolidated Aircraft Corporation, Buffalo, N. Y., plans installation of motors and controls, transformers and accessories, conveyors, etc., in new plant at San Diego, consisting of main unit and smaller buildings. Cost over $200,000.

Cincinnati, Ohio—United States Playing Card Company, Norwood, plans extensions and improvements in power plant for factory service. Cost about $25,000.

Denver, Colo.—Mile High Distillery Company, recently organized, care of Denver Builders, Inc., 1425 Welton Street, plans new plant. Cost about $75,000.

Alexandria, La.—Asks bids until July 17 for equipment for extensions and improvements in city-owned power plant, including steam turbine unit, three 750-hp. boilers with superheaters and accessories, forced draft fans, pumps, feedwater heaters and auxiliary equipment.

Sioux Falls, S. D.—Northern States Power Company, Minneapolis, Minn., has approved plans for alterations and improvements in power plant at Sioux Falls.

Saginaw, Mich.—Smith Agricultural Chemical Company, Columbus, Ohio, plans installation of transformer equipment, motors and controls, conveyors, loaders and other equipment in new branch commercial fertilizer plant at Saginaw. Cost about $85,000.

Jackson, Miss.—Is having surveys and estimates of cost made for new city-owned electric light and power plant by Burns & McDonnell Engineering Company, Kansas City, Mo., consulting engineer.

Manzanola, Colo.—Libby, McNeil & Libby, Chicago, Ill., plans installation of motors and controls, conveyors, loaders and other equipment in new food products canning plant at Manzanola. Cost about $50,000.

Baltimore, Md.—Big Four Distilleries, Inc., recently organized, care of Potomac Distilling Corporation, 2700 Wilmarco Avenue, plans power plant at new multi-unit distillery. Cost about $400,000.

Cleveland, Ohio—Morgan Steel Products Company plans installation of motors and controls, conveyors, etc., in new plant addition. Cost about $35,000.

Detroit, Mich.—Schmidt Brewing Company plans new addition to brewing plant and will equip primarily for bottling department. Cost about $40,000.

Washington, D. C.—Bureau of Supplies and Accounts, Navy Department, asks bids until July 10 for quantity of electric cable, cord and wire for Eastern and Western Navy Yards (Schedule 2800).

Deming, N. M.—Mimbres Valley Distillery Company plans new plant on Railroad Avenue. Cost about $50,000.

Westminster, Md.—Farmers Fertilizer & Feed Company plans installation of motors and controls, conveyors, loaders, etc., in connection with rebuilding of portion of commercial fertilizer works recently destroyed by fire. Loss about $70,000.

Dayton, Ohio—Standard Register Company plans installation of motors, controls, conveyors, etc., in new plant addition. Cost about $35,000.

Hoquiam, Wash.—Grays Harbor Pulp & Paper Company plans installation of heavy-duty motors and controls, conveyors and other equipment in new addition to pulp mill. Cost about $100,000.

Rockwall, Tex.—Plans new city-owned electric light and power plant. Financing is being arranged.

Chester, S. C.—Aragon-Baldwin Cotton Mills, Inc., plans changes and improvements in electrical system and facilities at local Baldwin mill, with installation of new equipment.

Lisbon, Ohio—National Brass & Copper Company, plant recently acquired by C. W. Hays and Floyd Rose, plans installation of motors and controls, regulators, conveyors and other equipment in new addition and for conversion of present works for steel mill. Cost about $150,000.

Deland, Fla.—Plans new city-owned electric light and power plant, and will arrange financing as soon as estimates of cost are completed.

Colfax, Wash.—City soon asks bids for new ornamental street-lighting system on portion of Main Street.

Morehead, Minn.—City plans installation of transformer station on First Avenue North, connecting with system of Northern States Power Company, for standby power service.

Glasgow, Mont.—United States Engineer Office, Kansas City, Mo., has low bid from A. S. Schulman Electric Company, Chicago, Ill., for construction of electrical distribution system at Fort Peck dam site, Missouri River, near Glasgow, at $398,478.34, and is scheduling early award.

MEN OF THE INDUSTRY

A. L. Powell New President of Illuminating Society

A. L. Powell, manager of the eastern office of the Nela Park engineering department of General Electric Company, has been elected president of the Illuminating Engineering Society for the year 1934-'35. He succeeds J. L. Stair, chief engineer of Curtis Lighting, Inc., Chicago.

An internationally known authority on illumination design and application, Mr.

Powell has been a pioneer in the fields of architectural, decorative and many other modern forms of lighting. A prolific writer, he has prepared numerous papers and articles on these subjects which have appeared in general and trade publications.

Upon his graduation from Columbia University, in 1910, Mr. Powell joined the engineering department of the Edison Lamp Works of General Electric Company at Harrison, N. J., becoming manager of that department in 1925. When the Edison Lamp Works and National Lamp Works were consolidated into the incandescent lamp department of General Electric Company and the Harrison group transferred to Nela Park, an eastern office of the Nela Park engineering department was organized and Mr. Powell placed in charge, devoting much of his time to consultation with architects, decorators and others collaborating in the elevation of lighting standards. He was a lighting consultant for the Rockefeller Center development and originated many of the ingenious effects to be found in Radio City Music Hall and other buildings.

Among his recent contributions to lighting progress has been his editorship of the Architectural Section of the I.E.S. *Transactions*, official publication of the Illuminating Engineering Society. Mr. Powell is a member of the U. S. National Committee of the International Commission on Illumination.

Other officers elected by the I.E.S. are L. A. S. Wood, manager of the lighting department of Westinghouse Electric & Manufacturing Company, vice-president; G. Bertram Regar, head of the lighting sales department of the Philadelphia Electric Company, vice-president; D. W. Atwater, Westinghouse Lamp Company, general secretary, and W. F. Little, Electrical Testing Laboratories, New York City, treasurer.

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E. R. Maurer Awarded Lamme Medal by S.P.E.E.

Edward R. Maurer, professor of mechanics at the University of Wisconsin, was awarded the seventh Lamme medal by the Society for the Promotion of Engineering Education at its annual meeting held last week at Cornell University. His teaching experience covers a period of more than forty years. Following graduation from the University of Wisconsin in 1890, he was first employed by the Chicago & Northwestern Railway and later by the U. S. Geological Survey. Joining the teaching staff at Madison as instructor in engineering, he subsequently was made assistant professor and in 1901 professor of mechanics, a position which he still occupies.

As an author Professor Maurer has helped both the engineering student and the practicing engineers. He has been a member of the S.P.E.E. since 1897 and holds membership also in the American Society for Testing Materials and the American Association for the Advancement of Science.

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J. S. Sutherland has been appointed manager of sales promotion for the Alabama Power Company. The sales promotion division was formerly known as the merchandise sales division.

Charles P. Myrick has been reappointed New England sales manager of the Edison Electric Appliance Company with headquarters at Boston, Mass.

R. R. Brown of Mount Clemens was elected president of the Michigan Electric Light Association at the recent annual meeting held in Grand Rapids.

Thomas C. Egan has been appointed to succeed the late Judge Woodruff on the Pennsylvania Public Service Commission for the term ending July 1, 1941. Mr. Egan is a graduate of Georgetown University, Washington, D. C. and of the Law School of the University of Pennsylvania. He is a member of the board of governors of the Bar Association of Philadelphia, where he is a prominent practicing attorney.

A. W. Altorfer has been elected president of Altorfer Brothers Company, Peoria, Ill., maker of ABC household washers and ironers, to fill the vacancy caused by the recent death of Silas H. Altorfer, his brother. They founded the company in Roanoke, Ill., in 1909, and A. W. Altorfer has held an executive position with it continuously since its start. **Henry W. Altorfer,** another brother, associated with the business fifteen years as secretary and since last fall general manager, has been made vice-president as well.

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F. B. Culley Assumes New Duties in Indiana

F. B. Culley was made executive vice-president and a director of the Southern Indiana Gas & Electric Company at a recent meeting of the board of directors. He will take charge of the company's affairs on July 1 and relieve **Frank J. Haas,** general manager, who, because of a nervous breakdown, has been forced

to give up business activities. For many years Mr. Culley was connected with the former Augusta-Aiken Railway & Electric Corporation, of which he became vice-president and general manager. Upon acquisition of that property by the Georgia Power Company Mr. Culley continued in charge until he accepted his new position in Evansville. He was born in Franklin, Va., in 1885, and received his education in the public schools and the Military Academy of South Carolina.

Mr. Haas has been identified with the Indiana utility since 1908. He has been active in electrical association work, being a past-president of the Indiana Electric Light Association.

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M. M. Samuels, formerly identified with the J. G. White Engineering Corporation, has been appointed economic analyst of the rate survey being made by the Federal Power Commission.

John Arms has been elected secretary of United Engineering Trustees, Inc., to succeed Alfred D. Flinn, resigned. Mr. Arms has been general manager of the corporation since December, 1933, and will continue to be, combining the duties of both offices. He will be the chief administrative officer for the board of trustees in caring for Engineering Societies Building, Engineering Societies Library and endowment funds which the corporation holds for the American Institute of Electrical Engineers, American Society of Civil Engi-

neers, American Institute of Mining and Metallurgical Engineers and American Society of Mechanical Engineers. Mr. Flinn, the retiring secretary, has occupied that position since 1918.

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A. A. Low Heads Utica Utility

At the recent annual meeting of the directors of the Utica Gas & Electric Company, A. Augustus Low was elected president to succeed the late William T. Baker. Mr. Low has been executive

vice-president of the company for the past three years. He is also vice-president of the Northern New York Utilities, Inc., and president of the Kanata Realty Company and the Old Forge Electric Corporation. He is president and treasurer of the Bog River Corporation and a director of the Raquette River Power Company. Stefaan Piek was named executive vice-president and Leland D. McCormac vice-president and general manager.

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John C. Damon, formerly engineer in the construction department of Jackson & Moreland, Boston, Mass., is now identified with the Public Service Commission of Wisconsin in the capacity of chief engineer. Since joining the commission staff Mr. Damon has given special attention to the development of the continuous inventory plan for public utilities, a new valuation practice formulated to replace the present expensive and troublesome methods for obtaining a rate base value of fixed capital property. Early in his career he was affiliated with public utility properties in various parts of the country, including the Chicago Telephone Company, Telluride Power Company, Trinidad Electric Transmission Railway & Gas Company and the Utah Power & Light Company. In 1918 he was detailed to the power section of the War Industries Board. In this capacity he was assigned to make studies of the power supply in several of the heaviest industrial districts of the East. After relinquishing these duties he entered the organization of the West Penn Power Company, subsequently joining Jackson & Moreland.

OBITUARY

Charles P. Prichard, vice-president and general manager of the Lynn (Mass.) Gas & Electric Company, died June 25 in his fifty-first year.

William S. Fisher, secretary of the Nevada-California Electric Corporation, Denver, died suddenly June 9. He was 49 years of age.

Edward D. Brown, general superintendent of the Sierra Pacific Power Company, Reno, Nev., died in Oakland, Calif., May 3. Mr. Brown had been in Reno since 1900, when he became a power house operator for the Reno Power, Light & Water Company. For the last fourteen years he had held the position of general superintendent of the Sierra Pacific system.

Wilhelm Pfannkuch, technical director of the A.E.G. high-tension cable works at Oberschonweide, Germany, died recently in his fifty-fifth year. He joined the A.E.G. Company in 1904 and became one of the leading German high-tension cable manufacturing experts.

Robert L. Tudor, president of the Western Power, Light & Telephone Company, Kansas City, Kan., died, of a heart attack, recently aboard a Santa Fe train. He was 44 years of age. Mr. Tudor became receiver for the company, originally known as the Western Power & Light Company, two years ago. He was formerly an executive of the Utilities Power & Light Company of Chicago, a part of the Harley L. Clarke interests.

Hermann C. Henrici, president of the Henrici, Lowry Engineering Company, consulting engineers of Kansas City, Mo., died recently, of a heart ailment, in his fiftieth year. Mr. Henrici was graduated from the Massachusetts Institute of Technology in 1906 and following his return to Kansas City he entered the engineering department of the Bell Telephone Company. It was in 1913 that he established the engineering firm with W. Malcolm Lowry. Mr. Henrici was a member of the American Institute of Electrical Engineers and of the American Society of Heating and Ventilating Engineers.

George A. Damon, consulting engineer of Pasadena, Calif., died June 23, in that city, of cerebral congestion. He was 63 years old. After his graduation from the University of Michigan in 1895 Mr. Damon spent sixteen years in association with Bion J. Arnold of Chicago. As an associate of Mr. Arnold he had charge of the design and construction of hydro-electric plants and took active part in examinations and reports on transportation problems, notably on operation and construction of New York subways and in Pittsburgh and Los Angeles. From 1911 to 1917 Mr. Damon was dean of the Throop College of Technology at Pasadena. He was a fellow of the American Institute of Electrical Engineers, and a member of the Western Society of Engineers, the Society for the Promotion of Engineering Education and of other technical associations.

Leonard P. Dickinson, professor of electrical engineering at the University of Vermont, died on June 3 at Burlington, Vt. Mr. Dickinson was 59 years of age, a native of Hill, N. H., and was educated at the Massachusetts Institute of Technology, graduating in 1896. Prior to 1921 he had taught electrical engineering at Lafayette College and Rhode Island State College.

Robert Wetherill, retired manufacturer of power-plant and transportation equipment, died at his home in Chester, Pa., June 18 after a short illness. He was 82 years of age. As a member of the firm of Robert Wetherill & Company he supervised the construction of some of the earliest power plants and transportation lines in Pennsylvania. He retired in 1916.

Oliver I. Steigerwalt, consulting power engineer, died June 24 at his home in Niagara Falls, N. Y., at the age of 60. Mr. Steigerwalt became affiliated with the Read-Coddington Engineering Company in 1921 and in this connection participated in the building of the Auxiliary Tunnel of the Niagara Falls Power Company. He was a native of Lancaster, Pa.

E. E. Towles, vice-president of the American States Electric Company, died in Chicago, June 19, of heart disease. Mr. Towles was formerly assistant chief engineer for the Missouri Public Service Commission. He was born in Jefferson City and was graduated from Missouri University.

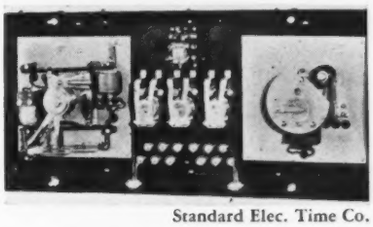
Russell E. Lawrence, founder of the Lawrence Institute of Technology in Detroit, died recently in that city. A graduate of the Rose Polytechnic Institute in 1913, he entered the turbine research department of the General Electric Company at Lynn, Mass. Subsequently he became a professor of mechanical engineering at the University of Detroit and in 1921 was promoted to dean of the engineering college. His services as consulting engineer were retained by many corporations. During the last two years he had carried on the Lawrence Institute.

Sir George Sutton, Bart., one of the best-known figures in the electrical wire and cable industry, died recently at Walmer, England, in his seventy-eighth year. Sir George was president of W. T. Henley's Telegraph Works Company and of Henley's Tire & Rubber Company. He had been associated with the Henley company since 1880, when the original business of the famous W. T. Henley was reorganized, and he became secretary. It was due to his efforts that the scope of the business was widened to provide for the growing demand for wires and cables for electrical power supply. He was a member of the Institution of Electrical Engineers, and vice-president of the Executive Council of the Federation of British Industries.

NEW EQUIPMENT

Demand Controller Limits Power Peaks

To aid power users in keeping down their peak demands the Standard Electric Time Company, Springfield, Mass., has developed a dust-proof, panel-mounted unit which indicates the rate of load approach to a predetermined limit and opens the main circuit breaker if the user takes no steps to keep his peak under control after bell and



Standard Elec. Time Co.

horn warning signals are sounded. The panel (shown in reverse view) is 32x16x 1 in. thick. On its front it carries two dials which show the percentage of the load limit attained at any moment (left) and the percentage of elapsed time which has occurred in the demand period (right). The rate at which the maximum demand is accumulating is obtained by transmitting impulses from the demand meter of the power company to the load-integrating mechanism on the panel.

The time duration indicator, which controls relay switch circuits through cams, making it impossible to sound signals or cut off the power supply if the demand does not reach the point requiring relay operation to these ends, is driven by a Telechron synchronous motor. The bell and horn signals can be set to warn of the termination of definite portions of the demand period. Expiration of stated demand periods is indicated by pilot lamps at the load centers. The load-integrating mechanism automatically resets to zero at the expiration of the stated demand measuring period. The design includes contact block assemblies to meet normal and seasonal demand requirements.

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Small appliance switches for single-hole mounting, particularly designed for the control of motor-driven appliances, electric tools, heating devices and other small heavy-duty appliances, have been announced by the merchandise department of the General Electric Company. They are available for single-pole, double-pole and three-way operation and are rated 6 amp., 250 volts and 12 amp., 125 volts. They are totally inclosed in "Textolite" and approved by the Underwriters' Laboratories. The small size of the switches, $1\frac{1}{2} \times \frac{7}{8} \times 15/16$ in. deep, makes them adaptable for gang mounting. They are supplied with nozzle lengths up to $\frac{3}{4}$ in. Switch action is short and positive, of the wiping contact type, and moving contacts are mounted on arc-snuffing, insulating disks. Large binding screw terminals give easy access to the binding screws, and spring contacts prevent leakage or excessive contact heating.

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Spiral-Record Recorders

An electrical operation recorder which provides a long spiral curve on a fast-moving circular chart has been introduced by the Bristol Company, Waterbury, Conn. The spiral record starts at the outer edge of the chart and gradually moves toward the center. It is accomplished by a telechron cam which continuously resets the record-making movement. One form has two telechron motors, one making one revolution in eight hours and one making one per hour; the resulting spiral record covers eight rotations of the chart with approximate $\frac{1}{4}$-in. spacing of the record line. Entire movement is housed in a rectangular Model 40M case.

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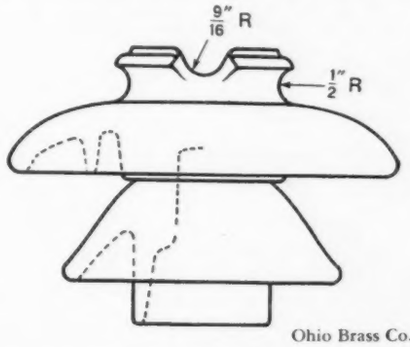
Pin-Type Insulators Are Redesigned to New Trends

To keep step with the trend to larger conductors and the use of armor rods on A.C.S.R. cable with pin-type insulators, the Ohio Brass Company, Mansfield, has increased the size of top and side grooves of its pin-type insulators. A survey of conductor specifications was made which indicated that No. 4/0 is the largest cable used normally on pin-type lines and therefore the top grooves



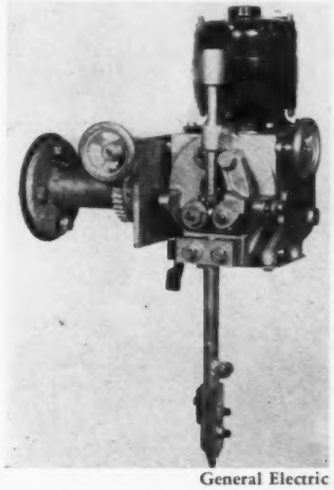
Ohio Brass Co.

of O-B insulators, ranging from 17,000 to 80,000 volt service, were increased to a $\frac{9}{16}$ in. radii, and the side grooves were increased to $\frac{1}{2}$ in. radii. These new grooves will also accommodate No. 4 A.C.S.R. conductors which with armor rod measure approximately 1 in. in diameter. The top groove provides a smooth, continuous seat in which the conductor is snugly held. The mechanical stress of conductor against insulator, therefore, is not localized and the armor rods are given a full opportunity to function as a protection to the cable.

•

Improved Control for Arc-Welding Head

Automatic arc-welding head and control equipment, identified as type WFA and featured by simplicity of design, control, adjustment to work and maintenance, is available from the General Electric Company, Schenectady. The standard type operates from 60-volt d.c. circuits. One small motor drives the electrode feed rollers through a simple worm reduction gear and three-speed transmission submerged in grease. At



General Electric

any of the three speeds selectable to suit conditions the electrode is fed at a uniform rate and the arc voltage accurately maintained. One small rheostat is the only adjusting element necessary. This means quick and accurate control of electrode feed, for all other operations are fully automatic. For positioning the electrode with respect to the work or for following irregular outlines of the work handwheels swing the nozzle through complete circles in two planes at right angles to each other.

Control equipment consists of an inclosed panel on which are mounted standard relays and contactors which maintain in proper sequence the operations necessary in starting, running and stopping the automatic head. The instrument panel may be located anywhere, but preferably as near the welding position as possible. It carries meters for reading arc voltage and current, the arc-adjusting rheostat, start-stop buttons, a forward-reverse switch for the electrode feed mechanism and a selector switch for either manual or automatic operation of a travel carriage if the latter is used.

•

Holders for three-light "Mazda" lamps have been announced by the merchandise department of the General Electric Company, Bridgeport, Conn. Control is obtained in the single units by a special 6-amp., 110-volt canopy

switch and in multiple units by a conveniently wired wall-type switch. Cord-sets for these new lampholders have rubber plugs molded on the cords.

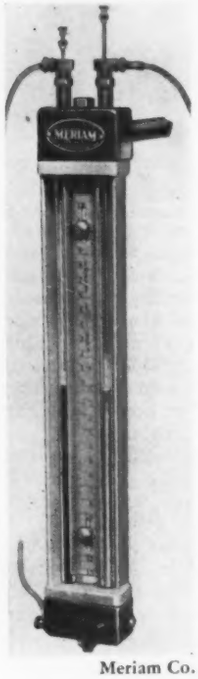
•

Clip-On Ammeters Expanded

"Clip-On" ammeters for extended ranges and in new physical sizes to accommodate busbars have been recently announced by Ferranti, Inc., New York. Originally offered as a dual range instrument with 100 and 500 amp. scales to measure from 10 to 500 amp., they can now be supplied in either single or dual ranges to measure currents from 1/10 of an ampere to 5,000 amp. New sizes now available have jaws to accommodate respectively 3⅜x2⅜ and 4½x3½-in. busbars. In the dual ranges self-contained transfer switches are employed to shift ranges. Both jaws of the instruments are insulated so that the meter may be used with safety on either insulated or uninsulated conductors. They are suitable for use on 25 to 125-cycle supply.

•

Manometers Linked to Automatic Control



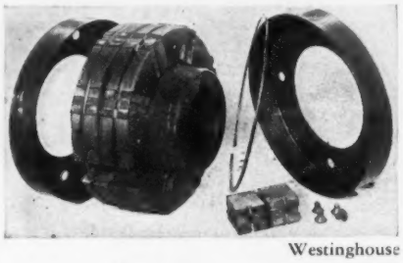
Meriam Co.

Manometers fitted with automatic electric control features have been announced by the Meriam Company, 1955 West 112th Street, Cleveland, Ohio. The instruments are said to be unusually rugged and simple and to remain permanently accurate under the severest service conditions. They are adaptable for a wide variety of direct and differential control uses for pumps, liquid levels in tanks and for maintaining gas or other pressures and flow between close limits, or for starting and stopping the flow in two pipes alternately for special purposes. Besides their direct electric remote control uses, they offer the additional advantage of providing a visible reading of performance.

In the type illustrated two separate glass tubes gasketed at their lower end into an iron block drilled to provide a U-connection are used instead of a single tube. Three terminals are provided, one on the block and the two others at the upper ends of the tubes. These latter terminals are connected to non-corroding adjustable tungsten wires which pass through the bakelite plugs in the upper ends of the tubes and which may be set so that either of them contacts with the mercury at the predetermined pressure or vacuum.

Flexible Couplings for Industrial Drives

General-purpose flexible couplings identified as type WH for use with gear-motors, speed reducers and other industrial drives up to speeds of 8,000 r.p.m. have been announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. Their cushioning action protects both driving and driven equipment against injury from shocks or vibration and helps to absorb starting or momentary overloads. Couplings consist of two identical steel flanged halves, two sheet steel cover plates, two snap or retaining rings and from five to twenty-two flexible elements, depending on the size. Torque ratings are from 1.87 to 1,870 hp. per r.p.m. for from 1 to 10-in. shafts.


Westinghouse

Radially around the periphery of each flange are rectangular slots to receive the cushioning and torsionally flexible elements. The torque-transmitting element is a rectangular steel plate and the cushioning elements are made from an exceptionally high grade hydraulic packing. The torque elements are placed in the center of a slot with a cushioning element on each side, thus these latter elements are subjected only to compression under load. The flexible elements and the periphery of the coupling flanges are provided with a groove, into which snap rings are inserted, preventing radial or lateral movement of the elements. To remove or replace the flexible elements the cover plates and the snap rings are removed, leaving the flanges and connected equipment undisturbed. Lubrication is unnecessary, since there are no metal-to-metal contacts of wearing parts. Details are available in Leaflet 72-130.

•

Inside control roof searchlights rugged enough for trouble-shooting and repair truck service have been introduced by the Port-a-lite Company, Cambridge, Mass. The lights are identified as "Roof-Beamolite" and are said to meet all of the requirements for a roof searchlight, and will actually develop a light beam of 300,000-cp. strength when required.

Combination fuse pullers and circuit testers, identified as "Star Test-Pliers," have been introduced by the Star Fuse Company, Inc., 235 Canal Street, New York. The pliers are made of bakelite and fiber with hinged test prongs on the ends of the handles in series with a small carbon lamp and 1,600-ohm resistance in one handle. They are rated for testing from 110 to 250 volts, but the lamp will indicate down to 65 volts and with resistance removed will have a range from 30 to 110 volts. Moisture or a high resistance leak in a panel will not light the lamp.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

Battery-Charging Rheostats and Resistors, Bulletin 2501 of the Ward Leonard Electric Co., Mount Vernon, N. Y., 4 pages, April, 1934. General battery-charging information and methods of making rheostat calculations together with illustrations, dimensions, connection diagrams, and catalog lists for Type 2501 battery-charging rheostats, resistors and their accessories.

Medart Rope-V-Drives Data and Price List, 42-page loose-leaf booklet containing bulletins MV, FHP and MVE 3404 of the Medart Company, St. Louis, Mo., April, 1934. Contains complete engineering and purchasing information on all types of multiple- and fractional - horsepower Medart V-belt drives.

Inspected Electrical Appliances, list published by the Underwriters' Laboratories established and maintained by the National Board of Fire Underwriters, 207 East Ohio St., Chicago, 269 pages, May, 1934. Lists the electrical appliances which comply with Underwriters' Laboratories requirements, and includes the various identifying labels, a list of markings used for identifying devices listed for reexamination service and an index.

Thermostatic Bimetal, 1934 Catalog of the W. M. Chace Valve Company, Detroit, on its thermocouple elements, 32 pages. Discusses the construction, operation, research and testing, application, specifications and temperature characteristics of Chace thermostatic bimetal available in eight standard types for temperatures from minus 50 to plus 1,200 deg. F. The catalog includes instructions for determining the type and dimensions to use, representative types of elements, and engineering formulas with sketches and illustrations.

Modern Store Lighting, Bulletin 34-20 of the Garcy Reflectors Division of the Garden City Plating & Mfg. Co., 1430 So. Talman Ave., Chicago, 4 pages. Sketches and engineering data on Garcy indirect store lighting equipment as adopted by leading department stores; methods of constructing built-in units are given.

For Automatic Reclosing of Oil Circuit Breakers immediate or delayed, Bulletin GEA-1909, the General Electric Company, Schenectady, 8 pages, May, 1934. Covers the application, construction, operation, dimensions and ratings of G.E. types AC-1, SM-3 and HG-13 automatic reclosing equipment and is illustrated with pictures and drawings of the equipment.

ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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Made in single, two and three-conductor types; for wide range of voltages; in gauges from 2,000,000 circular mils to No. 14 B&S. Braided or leaded. Also with steel, zinc or bronze tape, or round steel wire armor.

We would welcome your inquiry for further data or a copy of our complete wire and cable catalog.

OVER 60 OTHER TYPES

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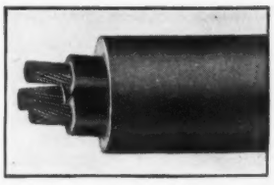
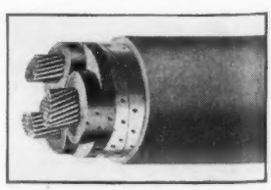


RUBBER INSULATED
Single, twin flat, three and four conductor



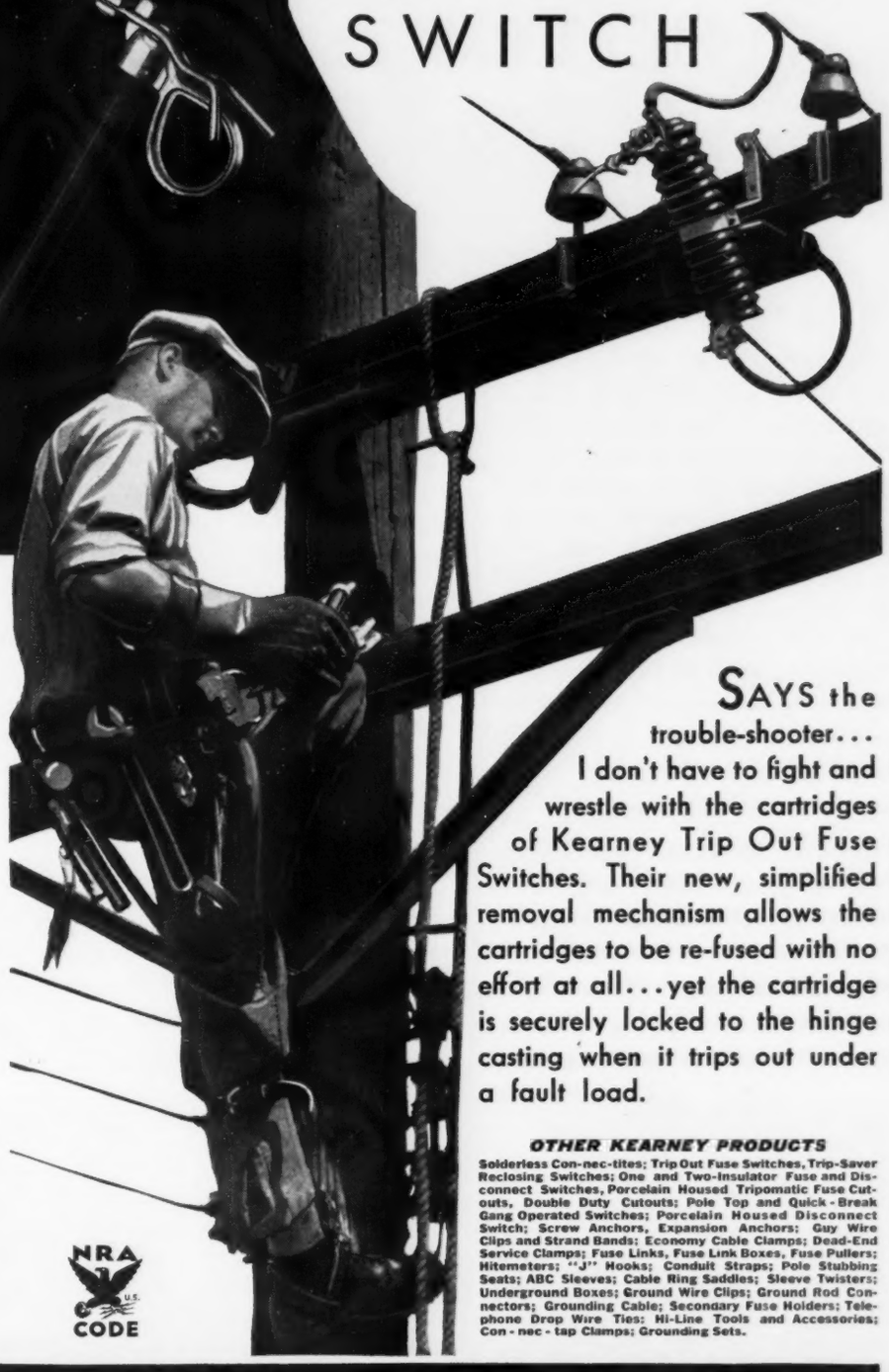
PAPER INSULATED
Unshielded or Type H; single or multiple conductor

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

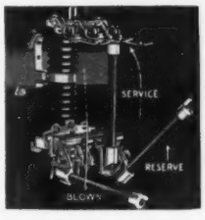
Doing the Job

with

KEARNEY TRIP OUT *FUSE* SWITCH

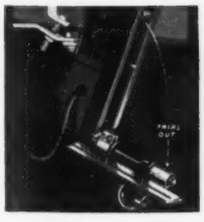


TRIP TYPE SWITCHES



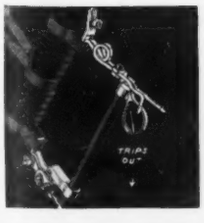
TRIP-SAVER RECLOSING SWITCH

Kearney Trip Savers are a different reclosing type of fuse switch. Their simple construction and positive operation will warrant your investigation.



TRIPOMATIC Fuse CUTOUT

Kearney Tripomatic Fuse Cutouts have the Trip Out Principle incorporated into a porcelain housing. They are made in standard ratings.



CONVERSION ASSEMBLIES

Conversion assemblies are available for converting any open type fuse switch rated 34,500 volts or less, to the Kearney Trip Out Principle.

SAYS the trouble-shooter... I don't have to fight and wrestle with the cartridges of Kearney Trip Out Fuse Switches. Their new, simplified removal mechanism allows the cartridges to be re-fused with no effort at all... yet the cartridge is securely locked to the hinge casting when it trips out under a fault load.

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OTHER KEARNEY PRODUCTS

Solderless Con-nec-tites; Trip Out Fuse Switches, Trip-Saver Reclosing Switches; One and Two-Insulator Fuse and Disconnect Switches, Porcelain Housed Tripomatic Fuse Cutouts, Double Duty Cutouts; Pole Top and Quick-Break Gang Operated Switches; Porcelain Housed Disconnect Switch; Screw Anchors, Expansion Anchors; Guy Wire Clips and Strand Bands; Economy Cable Clamps; Dead-End Service Clamps; Fuse Links, Fuse Link Boxes, Fuse Pullers; Hitemeters; "J" Hooks; Conduit Straps; Pole Stubbing Seats; ABC Sleeves; Cable Ring Saddles; Sleeve Twisters; Underground Boxes; Ground Wire Clips; Ground Rod Connectors; Grounding Cable; Secondary Fuse Holders; Telephone Drop Wire Ties; Hi-Line Tools and Accessories; Con-nec-tap Clamps; Grounding Sets.

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Intimate Reviews

OF ELECTRICAL NEWS AND OPINION

HEATING HOLYOKE

Somebody had a hot idea the other day at Mount Holyoke College —and it clicked!

Before the fall terms open, 180 G-E oil furnaces will be installed—90 of them as a central heating plant and the others located in smaller buildings on the campus—all under one operator's control. This wasn't such a bad idea when you consider that, in this case, a new plant was made unnecessary; that the furnaces will always operate at their maximum efficiency, because only the number needed will be used at any given time; that the savings are expected to pay for the installation in a few years; that health conditions may be improved because of better temperature regulation. And not the least advantage of this unique heating system is a new load for the local power company.

FOR THE POWER PARADE

As Boulder Dam grows from paper to power, G-E engineers and factory men are hard at work on this great project—building, and pioneering as they build. In Schenectady, two of the most powerful hydroelectric generators in the world are being fabricated. Rated 82,500 kv-a., their two million pounds will be toted away to the Colorado River next year in, or on, 40-odd freight cars. Meanwhile, eleven huge power transformers are coming into being at our Pittsfield Works, seven of them designed for the highest commercial voltage known among U.S. transformers. But even well-made circuits have to be opened. So, for the lines from the dam to Los Angeles, Philadelphia's G-E plant is building eight 287,500-volt impulse-type circuit breakers, which will do their job in 3 cycles—five hundredths of a second. They will be of such radically new construction that their total weight will be less than that of the oil alone in conventional breakers.

COMING EVENTS

Suppose kilowatt-hours were marbles and load builders were little boys. Then, suppose the boys dumped two billion marbles into your lap, representing new load added to your lines in one year. And if on succeeding days thousands of little boys added more marbles, the situation might need looking into.

More than two billion kw-hr. of new load were added to your lines last year. Your output at present is running within about 5 per cent of its all-time peak for the same season of the year. Every business day, thousands of load builders are being sold. And with the stimulation of the heavy-goods industries—well, we venture the question: How long will it take to provide more generating capacity? Records show from 13 to 28 months, depending on the size. Are you sure you can handle the '35 loads and winter peaks of '36 with your present equipment?

CARRY ON WITH CARRIE

From the hills of New Hampshire to the boulevards of Hollywood, power companies are finding new jobs for Carrie (carrier current, to you). In a few days she'll take over the control of domestic off-peak electric water heaters — 400 of them — in the City of Idaho Falls.

In this new role, Carrie's versatility will be well demonstrated. Not satisfied with energizing the heaters during just certain hours of each 24 to fill the valley in the night load, she'll turn them on, *on any feeder,* if the load on that feeder is down, *at any time.* (Note that this is true off-peak control.) Obeying the impulses from a two-frequency transmitter, she will also control street lighting.

For big and little remote-control jobs, for remote indication, for power-line relaying, telephoning, telemetering, and potential indication, carrier current is dependable. You should know.

96-18

GENERAL ELECTRIC

Stocks for Immediate Delivery

Through Graybar's 73 Warehouses

SPLICE with NATIONAL SEAMLESS SINGLE TUBE COPPER SLEEVES

The one best way to make line joints is with National Splicing Sleeves—*National Seamless Single Tube Copper* sleeves are unsurpassed for quality and efficiency. They are easy to install and make joints that are tight as a weld. Made from highest grade electrolytic copper that permits easy twisting. They are exact to size—ranging from 8 B. & S. to 500,000 C.M.

Manufactured by

The National Telephone Supply Co.
CLEVELAND, OHIO

All Items on this Page and "Everything Electrical"

Distributed and guaranteed by GraybaR ELECTRIC COMPANY

Offices in 73 principal cities

MERCOID-TRIPLEX TIME SWITCH

HAS MANY OUTSTANDING FEATURES WHICH MAKE IT DESIRABLE WHERE ACCURACY AND DEPENDABILITY ARE REQUIRED

Equipped with Waltham movement, synchronous motor and mercury switch to guard against corrosion, pitting, or open arcing.

Different types available for various applications. Write for Bulletin No. 115.

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Sole Manufacturers of The Mercoid Switch
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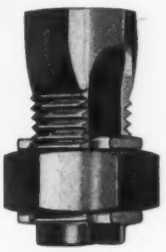

Reliable

CHAMFERED
SMALL-HEAD
SOLDERLESS
CONNECTORS

A strong and efficient hardware bronze connector in the low price class—with reversible nut—pilot to help thread the nut — and rounded slot edges.

Reliable Electric Co., Chicago

OSHKOSH

POLE LINE CONSTRUCTION TOOLS
SHOVELS AND SPOONS

Pike Poles	Peavies
Extra Handles	Cant Hooks
Reels	Lug Hooks
Diggers	Pole Supports
Barricades	Tree Trimmers and Saws
Warning Signs	Tamping Bars
Ladders	Digging Bars

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GRAYBAR ELECTRIC CO.
Manufactured By
LEACH COMPANY, Oshkosh, Wis.

THOMAS INSULATORS

The performance of Thomas Porcelain Insulators signifies a rugged *Permanence* which eliminates needless replacements. Cut your maintenance costs and build for future years by installing Thomas Insulators now.

THE R. THOMAS & SONS CO.
LISBON, OHIO

WESTERN RED Cedar Poles NORTHERN WHITE

NATIONAL POLE AND TREATING CO., Minneapolis, Minn.

TREATED OR UNTREATED, ROOFED, GAINED, BORED, OR STAINED, *STOCKED FOR IMMEDIATE DELIVERY*

NATIONAL 1934 PERMEX

YARDS AND TREATING PLANTS:
EVERETT, WASH. SPOKANE, WASH.
SAND POINT, IDAHO
MINNESOTA TRANSFER, MINN.

Grips... KLEINS

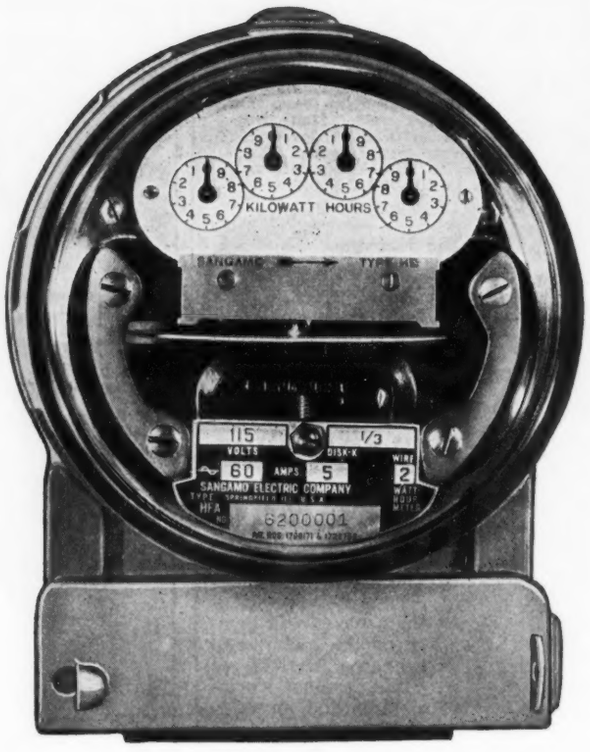
When Klein Grips seize a wire, they hold with the tenacity of a bulldog. The harder they pull the tighter they hold. Linemen everywhere rely on Klein Grips—the maximum in quality "since 1857."

Mathias KLEIN & Sons
Established 1857 Chicago Ill USA
3200 BELMONT AVE., CHICAGO

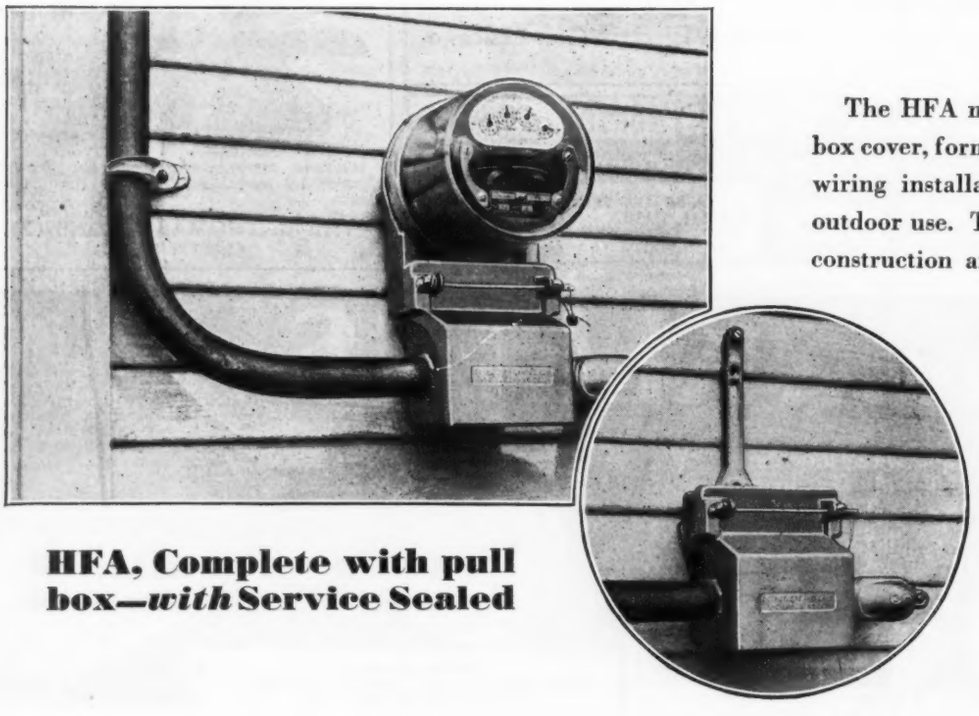
Foreign Distributor:
International Standard Electric Corporation,
67 Broad Street, New York

MODERN METER

For new sequence



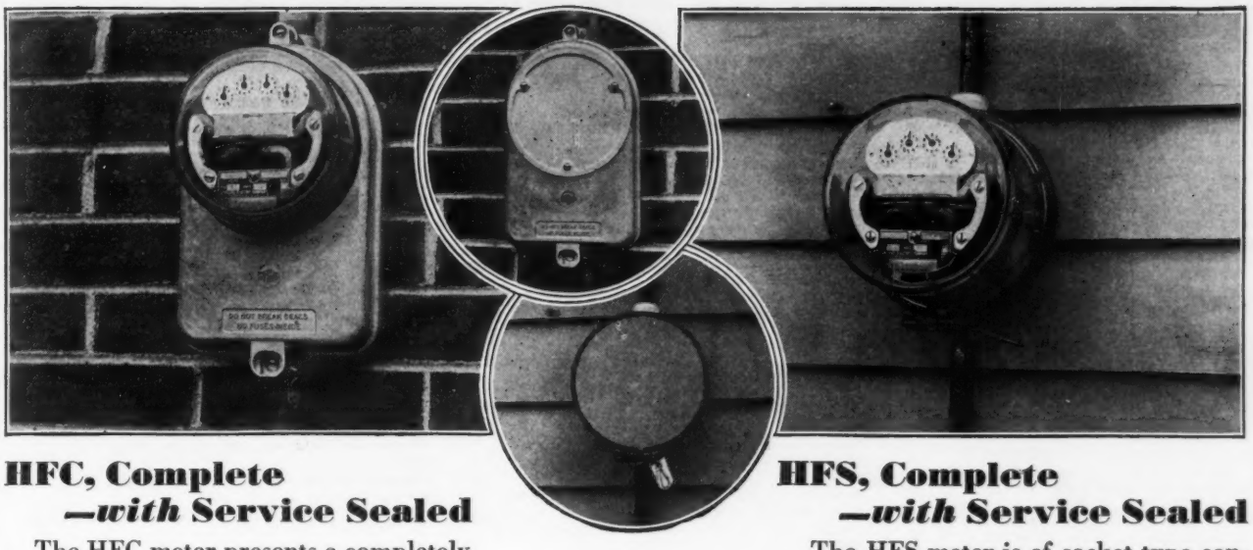
The Sangamo HF Meter forms the nucleus of the entire line of HFA-B-C and S meters, for modern new sequence installations. The HFA is perfectly adapted to existing installations, and from it are evolved, readily and inexpensively, the various combinations illustrated.



HFA, Complete with pull box—*with* Service Sealed

The HFA meter with pull box and pull box cover, forms a diversion proof, enclosed wiring installation suitable for indoor or outdoor use. The pull box is of open front construction and has convenient triple knockouts at back, bottom and sides. A special bracket to facilitate mounting on frame houses, will carry either the A or B meter. All exposed parts of A, B and C meters are of corrosion proof die cast aluminum alloy.

installations



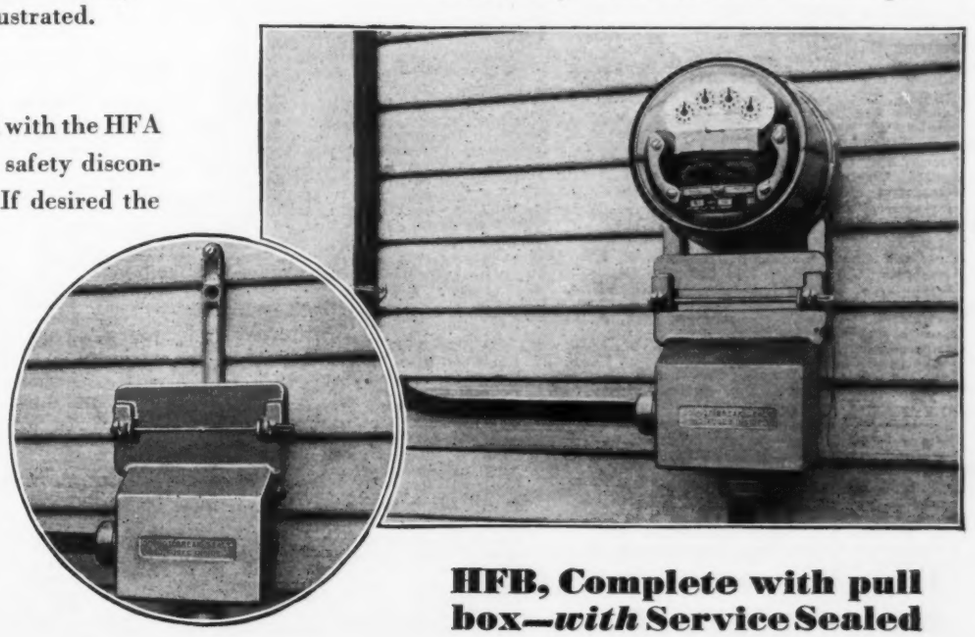
HFC, Complete —*with* Service Sealed

The HFC meter presents a completely armoured combination. Safety disconnects similar to the B construction are incorporated. The method of sealing when meter is removed is illustrated.

HFS, Complete —*with* Service Sealed

The HFS meter is of socket type construction. The meter proper is standard HF design, and differs from other HF meters only in the method of mounting.

The HFB meter is identical with the HFA meter except that it includes safety disconnects in the terminal block. If desired the safety block may be left connected to the wiring, when the meter is removed. Either the A or B meter may be removed and the service protected by a pull box top, the complete enclosure being sealed by the pull box cover.



HFB, Complete with pull box—*with* Service Sealed

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

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- Lowest Original Cost
- Lowest Installation Cost
- Lowest Maintenance Expense

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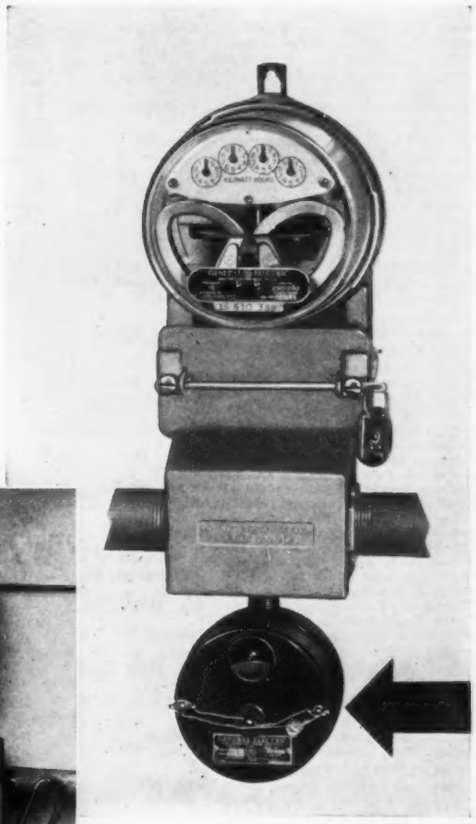

This illustration shows a recommended installation of the time switch with the new I-20 watthour meter. It attaches directly to service entrance cabinets, conduit fittings, or pull boxes . . . . no unnecessary wiring.

One of many accepted installation practices, which connects the time switch to a standard I-16 watthour meter. The meter measures the current to the water heater only.

GENERAL ELECTRIC

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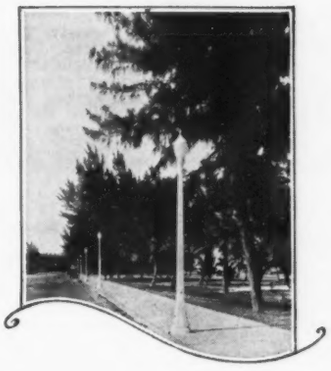

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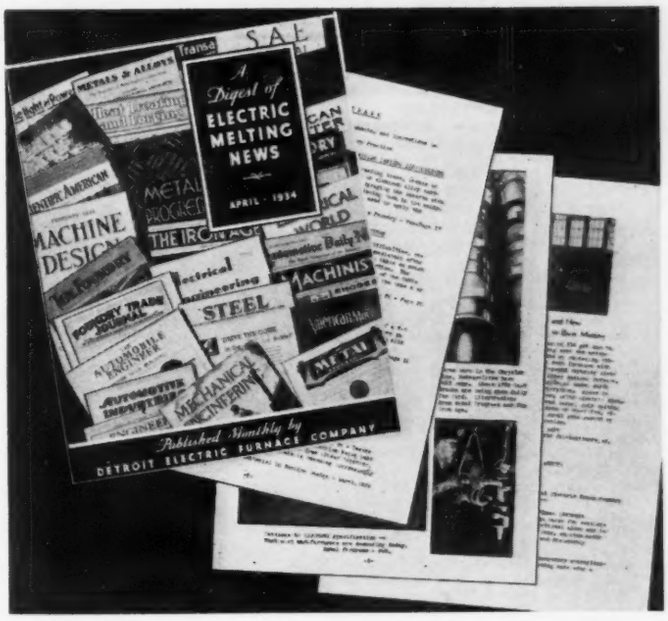

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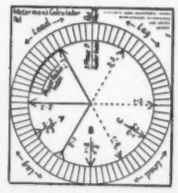

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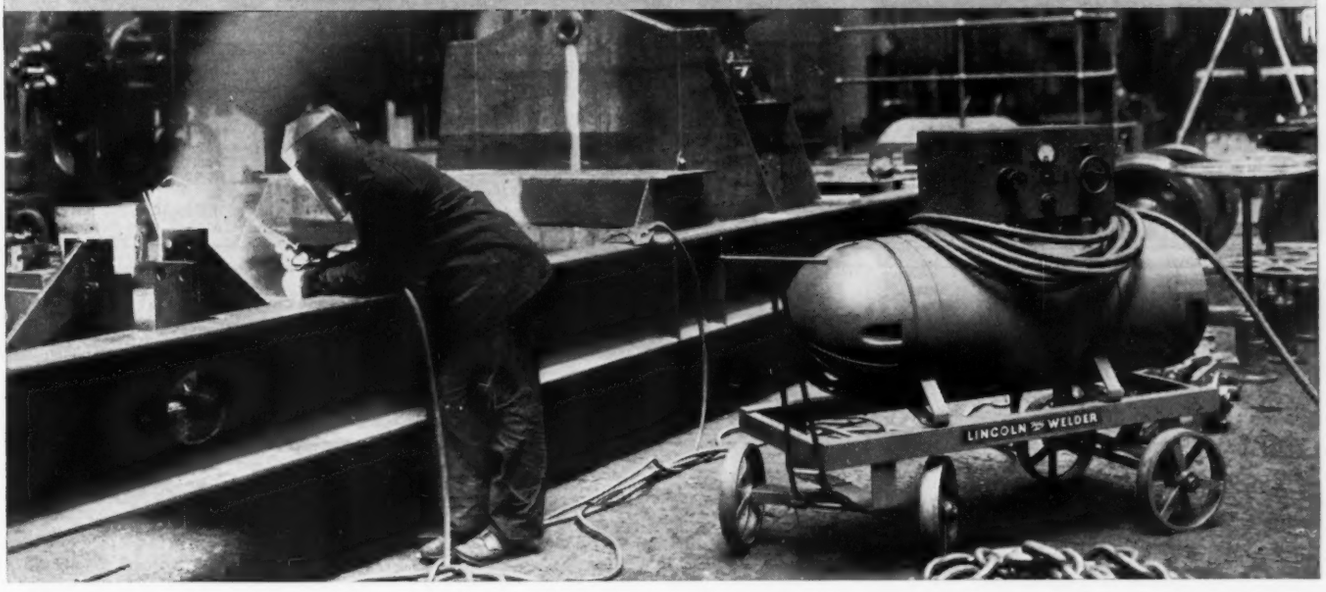

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TREASURY DEPARTMENT, Procurement Division, Public Works Branch, Washington, D. C.—Sealed bids in duplicate will be publicly opened in this office at 3 p.m., July 18, 1934, for furnishing all labor and materials and performing all work required for installing one passenger elevator in the U. S. P. O., etc., extension and remodeling at Hannibal, Mo. Attention is directed to bulletin No. 51 of Federal Emergency Administration of Public Works and Executive Order No. 6646 attached. Proposals will be considered only from individuals, firms or corporations regularly engaged in the business of installing and servicing of elevators who have the requisite record of satisfactory performance of elevator installations of similar type and importance. Each bidder must submit with his bid, a "statement of facts as to qualifications to furnish and install elevators in strict accordance with the specifications" in detail of such data as may be required including the business and technical organization of

U. S. Government

the bidder available for the contemplated work, financial resources, building experience, materials, elevator, equipment and accessories proposed to be used, that are identical to the equipment herein specified and locations of buildings having elevators installed by bidder identical to those herein specified which are of a make and type known to the Procurement Division, Public Works Branch, to have given satisfactory service and to have been in operation for a reasonable period. The United States expressly reserves the right to reject any bid in which the facts as to business and technical organization, financial resources or building experience compared with the project bid upon, or materials, elevators, equipment and accessories proposed to be used are not strictly in accordance with specification requirements, or failure of bidder to show buildings in which he has installed identical equipment to that herein specified which are of a make and type known to the Procurement Division,

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Public Works Branch, to have given satisfactory service and to have been in operation for a reasonable period, etc., justify such rejection. No bid will be considered unless it includes or is accompanied by a certificate duly executed by the bidder stating that the bidder is complying with and will continue to comply with each approved code of fair competition to which he is subject, and if engaged in any trade or industry for which there is no approved code of fair competition, then stating that as to such trade or industry he has become a party to and is complying with and will continue to comply with an agreement with the President under Section 4 (a) of the National Industrial Recovery Act. Drawings and specifications may be obtained at this office in the discretion of the assistant director of Procurement, Public Works Branch. W. E. REYNOLDS, Assistant Director for Public Works. (262)

Continued on the opposite page

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1	350	600	440	3	Westg.
2	125	900	2300	3	Cr.-Wh.
2	100	900	2300	3	G.E.

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No.	Hp.	R.p.m.	Volts	Type
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1	600 kva.	900	440	G.E. Syn. Cond.
1	500	150	2300	Elec. Mch. Syn.
1	500	900	440/4000	Westghse. Syn.
1	500	900	440/2200	G.E. Syn.
1	350	900	2200/4000	Wh. Syn.
2	300	600	445/2300	G. E. Syn.
1	250	600	2200/4000	G.E. Syn.
1	250	600	220/440	Westghse. Syn.

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700	2300	G.E.	900
220	220–440	G.E.	450
200	440–220	G.E.	600
150	2200–440–220	G.E.	514
150	2200–220–440	G.E.	720
150	220–440–550	G.E.	600
100	220–440	G.E.	450
100	2200–440–220	Westghse.	1200
100	550	Wagner	720
100	2200–550	Westghse.	900
100	440–220	G.E.	720
100	550	G.E.	900
75	440–220	G.E.	900
50	2200	G.E.	514

SYNCHRONOUS MOTORS, 3-PH. 60-CY.

300	220–440	G.E.	600
240	2200–440–220	G.E.	600
172	2200–440–220	G.E.	720
160	2200–440–220	G.E.	600
120	2200–550	G.E.	900

MOTOR GENERATOR SETS

1—225-kw., 125-V., 1200 r.p.m., G. E. MPC connected to ATI, 2300 V., 60 cy. syn. motor.
1—200-kw., 250-V., 1200 r.p.m., Reliance connected to El. Mach. 2400/4150 V., 60 cy. syn. motor.
1—150-kw., 250/125-V., 3 wire, 900 r.p.m., Whse. SK. connected to Whse. 2400/4150 V., syn. motor.

A. C. GENERATORS

1—250-kva., 600-r.p.m., 240-480-V., G.E.
1—225-kva., 600-r.p.m., 2200-240-480-V., G.E.
1—112½-kva., 1200-r.p.m., 2300-240-280-V., G.E.
1—112½-kva., 900-r.p.m., 2200-240-480-V., G.E.
1— 62½-kva., 1200-r.p.m., 480-240-V., G.E.
1— 37½-kva., 1200-r.p.m., 480-240-V., G.E.
1— 30-kva., 1200-r.p.m., 2300-480-240 Whse.

TRANSFORMERS

SALES AND REPAIR SERVICE

3—667 KVA G-E Transformers Type H, Form KSD, 60 cycle, 4254/7370Y-230/115 volts, very late type, practically new.

$975.00 EACH

We carry a complete stock. Write for Catalog No. 128-B
All transformers guaranteed for one year.

THE ELECTRIC SERVICE COMPANY, Inc.

"America's Used Transformer Clearing House" **Station M, Cincinnati, Ohio**

FOR SALE

BARGAIN

300 K.W. 2-60-2300
ALLIS TURBINE
with Auxiliaries

ELECTRIC MOTORS COMPANY
219 First Street S.W.
Cedar Rapids, Iowa

MOTORS—3 PH., 60 CY.

Hp.	Type	Speed
800	G. E. sl. rg.	720
600	G. E. syn.	860
2-600	G. E. sl. rg.	252
600	G. E. syn.	257
600	Al. Ch. syn.	240
3-675	Al. Ch. syn.	900
400	West sl. rg.	514
400	Al. Ch. syn.	300
300	Al. Ch. sl. rg.	585
260	Al. Ch. syn.	720
250	West. sl. rg.	720
200	G. E. sl. rg.	1200
200	West sl. rg.	500
200	F.M. sl. rg.	600
150	G. E. sl rg.	1750
150	G. E. sq. c.	1750
100	Cr. Wh. syn.	225

ENGINE GENER.
1-400 kva., Cr. Wh., 240 v., 3 ph., 60 cy., 120 r.p.m. to Hamilton Corliss Engine.

MOTOR GENER.
1-750 kw. G. E. MPC., 250 v., D.C. Gener. to 1100 hp. G. E., ATI, synch. motor, 2200-3-60-900 r.p.m.

CENTRIF. PUMPS
3-14,000G.P.M., 150′ Head dir. conn., 675 hp. Al. Ch. 900 r.p.m syn. motors.
1-14,000 G.P.M., 60′ Hd., dir. conn. 260 hp., Al. Ch. 72 0r.p.m.

Above are a few of our stock items.

BELYEA CO., INC. 151 W. 18th St., New York City
REBUILT GUARANTEED

"SEARCHLIGHT" RATES

Electrical World

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Positions Wanted—5 cents a word, minimum charge—$1.00 an insertion.

Positions Vacant and other classifications—10 cents a word, minimum charge $2.00 an insertion. Allow 10 words for box address. No additional charge for forwarding replies.

Discount of 10% for payment in advance on 4 consecutive insertions of undisplayed advertisements.

Proposals—40 cents a line.

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Space is sold by the "inch," with 30 inches to a page. (An "inch" measures approximately 1 inch high by 2¼ inches wide.) Rates are from $6.00 to $3.50 an inch, depending on the total space used.

BELT DRIVEN A.C. GENERATORS
SYNCHRONOUS MOTORS
MOTOR GENERATORS
NEW D.C. MOTORS

L. J. LAND
Established 1910
142 GRAND STREET, N. Y. CITY, N. Y.

ELECTRICAL ENGINEERING

A BROAD, basic, intensive course for men of limited time, complete in one school year. Approved by educators, endorsed by industry. Modern buildings. 41 years' successful experience. Catalog on request.

BLISS ELECTRICAL SCHOOL
236 Takoma Ave., Washington, D. C.

POSITION VACANT

DISTRIBUTION engineer wanted. Responsible position with operating organization American owned public utility in Far East. Must have following qualifications: graduate recognized engineering school in electrical engineering, 30 to 35 years old, not less than 8 years' experience operating, design and construction of overhead and underground distribution and transmission systems, including substations preferably on large city distribution and a-c network systems. Thorough knowledge economics of distribution and transmission and theoretical calculations pertaining to operation and design. Thorough knowledge of switchgear, protective equipment, relays and underground cables up to 33,000 volts. Send complete experience record including full length recent photograph. P-275, Electrical World, 330 West 42d St., New York City.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000 This thoroughly organized advertising service of 24 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If you have actually earned over $2,500, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y. (E. W.)

HIGH GRADE men desiring salaried positions paying up to $20,000 are invited to contact responsible employers through our individual and confidential methods. Write for details. Established 1915. H. H. Harrison, Director, The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

ELECTRICAL ENGINEER, age 32. Plant operation, distribution, industrial, design, survey, and administrative experience. Box 14, 916 Spruce St., Phila., Pa.

ILLUMINATING ENGINEER, A.B., E.E., young, single, now employed, desires position with progressive power or manufacturing concern. Location immaterial. Best references regarding character, experience and ability. PW-268, Electrical World, 883 Mission Street, San Francisco, Calif.

METERMAN, sixteen years' wide experience. Will go anywhere at moderate salary. PW-274, Electrical World, 520 No. Michigan Avenue, Chicago, Ill.

SALESMAN WANTED

Sales Engineer

Wanted by manufacturers of automatic control instruments. Must be free for unlimited travel and location in United States, Canada or England after factory training course. Candidates preferred who were born and educated in England and have had practical engineering or industrial operating experience in the British Isles. Highest character references and engineering education required with preference for electrical, mechanical and chemical courses. Write, stating age, education and experience. SW-273, Electrical World, 330 West 42d St., New York City.

WANTED

Diesel Engine, Also Generator

Want a 15 to 30 horsepower Fairbanks Y type. Clover Valley Poultry Farm, Ramsey, Indiana.

U. S. Government

(Continued from opposite page)

TREASURY DEPARTMENT, Procurement Division, Public Works Branch, Washington, D. C.—Sealed bids in duplicate and of Executive Order No. 6646, dated March 14, 1934, will be publicly opened in this office at 2 p.m., July 11, 1934, for furnishing all labor and materials and performing all work for illuminated directional signs for the U. S. Post office at Paterson, N. J. Drawings and specifications may be obtained from the custodian of the building or at this office in the discretion of the assistant director of Procurement, Public Works Branch. W. E. REYNOLDS, Assistant Director of Procurement, Public Works Branch. (261)

(POSITION VACANT)

Wanted competent distribution transformer designing engineer. Must be reasonably familiar with manufacturing problems of transformer design. Reply giving age, salary desired and full details of experience.

P-272, Electrical World
520 No. Michigan Ave., Chicago, Ill.

CHANCE ANCHORS

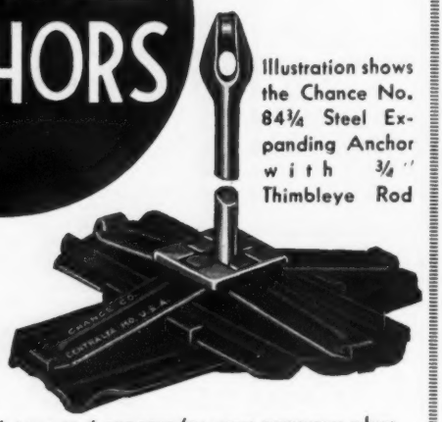

Illustration shows the Chance No. 84¾ Steel Expanding Anchor with ⅜" Thimbleye Rod

You'll save much time and expense for your company when you specify CHANCE ANCHORS. There is a type and size for every job.

Distributed everywhere by leading electrical wholesalers.

Write for bulletins.

Chance Company

CENTRALIA, MISSOURI.

WORLD'S LARGEST ANCHOR MANUFACTURERS

Electric Bond and Share Company

Two Rector Street
New York

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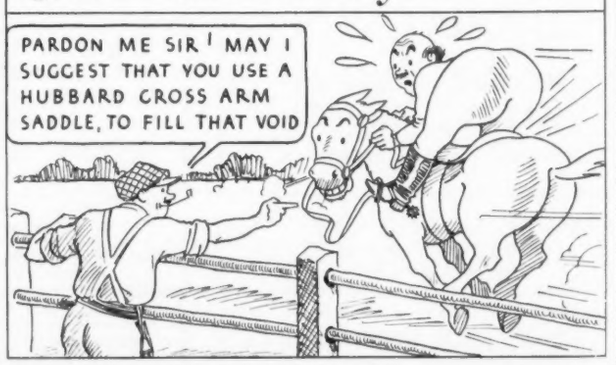
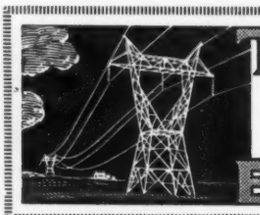
John Lineman Says.....





TOWERS

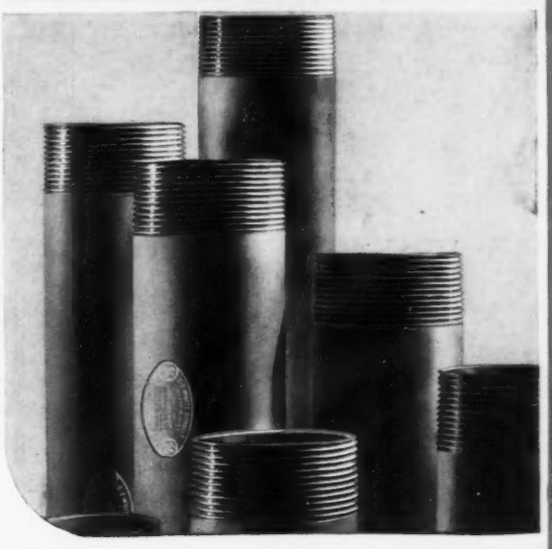
Transmission Towers, Radio Towers, Floodlight Towers, Malone Anchors.

BLAW-KNOX COMPANY
Pittsburgh, Pa.

BLAW-KNOX

Use G-E WHITE
TO SAFEGUARD WIRING

Explosion-proof . . Hot-dipped Galvanized . . Tough Glyptal Coating Inside and Out . . Resists Acids, Alkalis, and Moisture



Use G-E ONE-TIME or RENEWABLE FUSES

For Low-cost Operation . . Positive Protection . . Accurate Rating . . Durable Construction

For complete information on the products mentioned above, call a G-E Merchandise Distributor or write Section CD-217, Merchandise Dept., General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

WIRING MATERIALS

MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONNECTICUT

UNIV OF MICHIGAN CC
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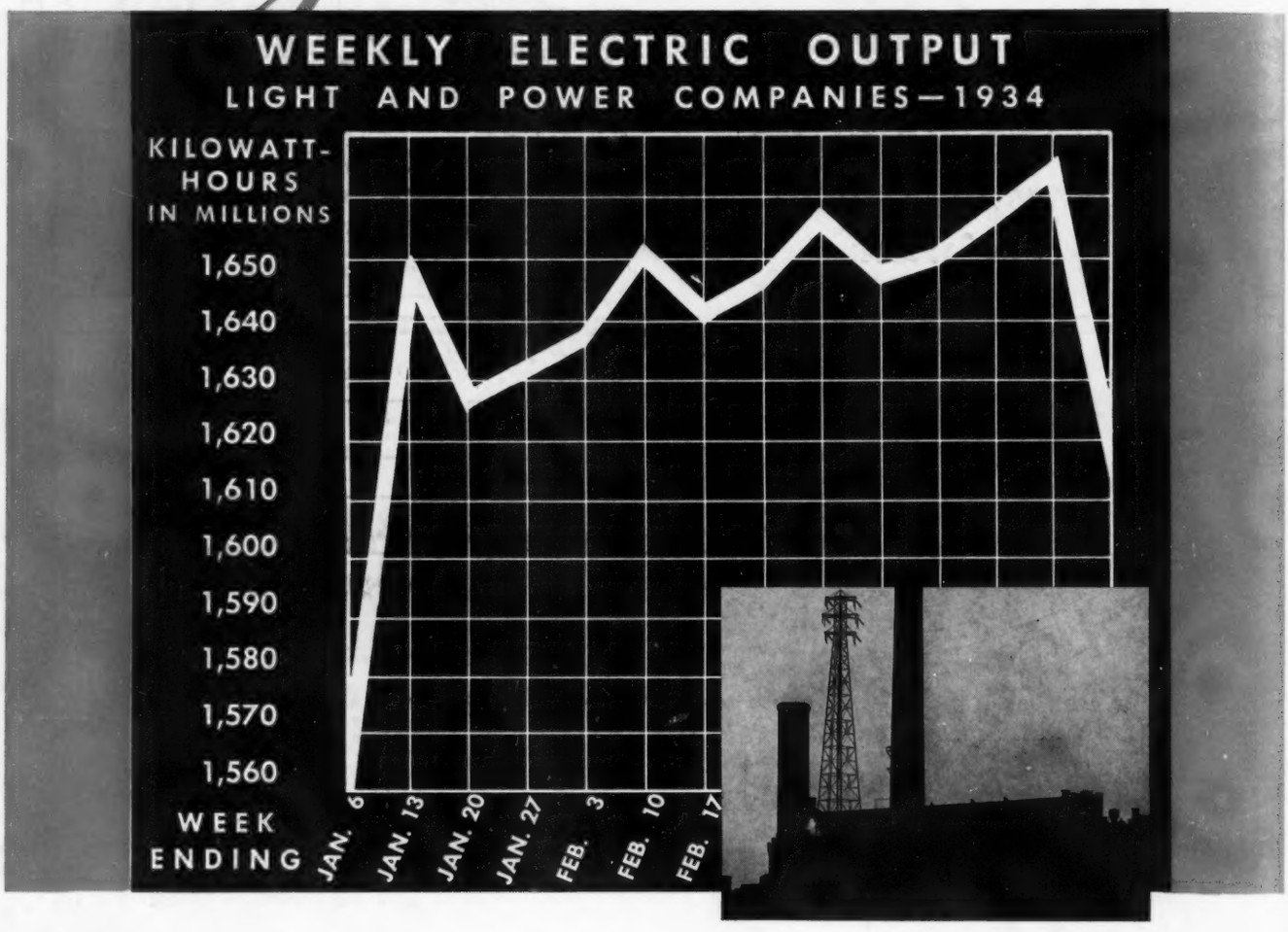
ANN ARBOR MICH

Does greater output always mean *Greater* profits?



CENTRAL STATIONS, the world over, prove that profits do not always keep pace with kw.-hr. output. They prove that when Texaco *tested* Lubricants are used, profitable operations are more likely.

TEXACO REGAL OILS *for Turbines*—are Texaco *tested* Lubricants renowned for resistance to sludging and emulsification. Their exceptional purity—uniformity—*reduce lubrication costs.*

TEXACO URSA OILS *for Diesels*—are Texaco *tested* Lubricants with consistently less carbon forming elements than any other oils available. They are dependable and economical. America's largest Diesel operators find they *cost less.*

TEXACO *tested* LUBRICANTS have been proved right for every central station requirement. Texaco Lubrication Engineers are familiar with central stations. Write to The Texas Company.

IMPORTANT: Valuable operating and lubricating data are yours without cost or obligation. Address Dept. R6, 135 East 42nd Street, New York City.

TEXACO

tested LUBRICANTS

The Texas Company, 135 E. 42d St., N.Y.C. ★ *There is a Texaco* tested *Lubricant for every purpose*